# MULTIPLE USE WATER SERVICE IMPLEMENTATION IN NEPAL AND INDIA

## Experience and Lessons for Scale-up

MONIQUE MIKHAIL AND ROBERT YODER

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## List of Abbreviations

PART 1 NEPAL

**ADB** Asian Development Bank

**ADO** Agriculture Development Officer

**AT** Agriculture Technician

**CBWSSP** Community Based Water Supply and Sanitation Project affiliated with DWSS

**CBO** Community-Based Organization

**CEAPRED** Center for Environmental and Agricultural Policy Research, Extension and Development

**DADO** District Agriculture Development Office

**DDC** District Development Committee

**DM** District Manager

**DoA** Department of Agriculture

**DoI** Department of Irrigation

**DoLIDAR** Department of Local Infrastructure Development and Agricultural Roads housed within the Ministry of Local Development

**DWSS** Department of Water Supply & Sewerage

**Fund Board** Rural Water Supply and Sanitation Fund Development Board affiliated with DWSS

**INGO** International Non-government Organization

**IT** Irrigation Technician

**LA** Learning Alliance

**MS** Marketing Supervisor

**MUS** multiple-use water systems in a general sense, as well as the Multiple-Use Services project funded by the Challenge Program on Food and Water with the International Water Management Institute as the lead and implemented by International Development Enterprises (IDE-Nepal) in Nepal

**NEWAH** Nepal Water for Health

**NFIWUAN** National Federation of Irrigation Water Users Association, Nepal

**NGO** Non-governmental Organization

**NITP** Nonconventional Irrigation Technology Project, housed within the DoI

**SAPPROS** Support Activities for Poor Producers of Nepal

**SIMI** Smallholder Irrigation Marketing Initiative

**SM/CM** Social Mobilizer and Community Mobilizer

**VDC** Village Development Committee

**WUC** Water User Committee

## PART 2 MAHARASHTRA, INDIA

**BDO** Block Development Officer
**CBC** Capacity Building Consortium
**GP** Gram Panchayat
**LA** Learning Alliance
**SAC** Social Audit Committee
**SHG** Self-Help Group
**SO** Support Organization
**TSP** Technical Service Provider
**VWSC** Village Water and Sanitation Committee
**WEC** Women Empowerment Committee

# MULTIPLE-USE WATER SERVICE IMPLEMENTATION IN NEPAL AND INDIA

Experience and Lessons for Scale-Up

# PART 1 THE NEPAL EXPERIENCE

## INTRODUCTION

Multiple-use water services (MUS) describe a participatory, integrated, and poverty-reduction focused approach that takes a community's diverse water needs as the starting point for providing services. Multiple-use water services move beyond the conventional sectoral barriers of the domestic and productive sectors and provide for all water needs in a community. The CGIAR Challenge Program-Multiple-Use Water Systems (CP-MUS) project was funded by a grant from the Challenge Program on Water and Food with the International Water Management Institute as the lead organization.[1] The project was focused on developing guidelines for multiple-use water services delivery as an effective way to use water for poverty alleviation and gender equity.

Implementation of the CP-MUS project in Nepal occurred largely through the Smallholder Irrigation and Market Initiative (SIMI), which is a USAID-funded project being implemented by Winrock International as the lead organization with International Development Enterprises (IDE) and other local partners, including: the Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED), Support Activities for the Rural Poor (SAPPROS) and the Agricultural Enterprise Center (AEC).

However, as success on MUS implementation became evident, it was integrated into other projects that IDE-Nepal and Winrock have partnered on: Ujyalo, Business Development Services—Marketing and Production Services (BDS-MaPS), and BDS-MaPS PRIME.[2] The tables below show the breakdown of the number of MUS projects implemented by the various IDE/Winrock Nepal programs.

**Breakdown of MUS projects by year and program**

| Year | Program | District | Number of Projects | Total |
|---|---|---|---|---|
| 2003–04 | IDE-Dutch grant | Palpa | 2 | 2 |
| | SIMI | Syangja | 4 | 12 |
| | | Palpa | 5 | |
| | | Surkhet | 3 | |
| 2004–05 | SIMI | Syangja | 2 | 9 |
| | | Palpa | 2 | |
| | | Surkhet | 3 | |
| | | Kaski | 2 | |

| | | | | |
|---|---|---|---|---|
| 2005–06 | SIMI | Syangja | 3 | 11 |
| | | Palpa | 3 | |
| | | Surkhet | 3 | |
| | | Kaski | 2 | |
| | BDS MaPS | Lalitpur | 1 | 1 |
| | Ujyalo | Gulmi | 3 | 17 |
| | | Arghakhanchi | 2 | |
| | | Lamjung | 4 | |
| | | Salyan | 2 | |
| | | Pyuthan | 2 | |
| | | Doti | 2 | |
| | | Dadeldhura | 2 | |
| 2006–07 | SIMI | Syangja | 2 | 8 |
| | | Palpa | 2 | |
| | | Surkhet | 2 | |
| | | Kaski | 2 | |
| | BDS MaPS | Lalitpur | 1 | 2 |
| | | Syangja | 1 | |
| | LEMI | Dhading | 2 | 6 |
| | | Makwanpur | 1 | |
| | | Kavre | 2 | |
| | | Udaypur | 1 | |
| 2007–08 | SIMI | Syangja | 1 | 8 |
| | | Palpa | 2 | |
| | | Surkhet | 1 | |
| | | Kaski | 2 | |
| | | Lalitpur | 1 | |
| | | Dadeldhura | 1 | |
| | RPI | Palpa | 2 | 5 |
| | | Kaski | 3 | |

**Total Number of MUS Systems Built by Each Program from 2003–2008**

| | |
|---|---|
| IDE-Dutch | 2 |
| SIMI | 48 |
| Ujyalo | 17 |
| BDS MaPS | 3 |
| LEMI | 6 |
| RPI | 5 |
| Total | 81 |

**Total Number of MUS systems built in each district from 2003–2008**

| | |
|---|---|
| Palpa | 18 |
| Syangja | 13 |
| Surkhet | 12 |
| Kaski | 11 |
| Lamjung | 4 |
| Gulmi | 3 |
| Lalitpur | 3 |
| Arghakhanchi | 2 |
| Salyan | 2 |
| Pyuthan | 2 |
| Doti | 2 |
| Dadeldhura | 3 |
| Udaypur | 1 |
| Kavre | 2 |
| Makwanpur | 1 |
| Dhading | 2 |

There are three distinct regions within Nepal—the high mountains region, middle hills, and Terai, the flat fertile area in the south of the country, bordering India. All of the multiple-use services projects implemented in Nepal were in the middle-hills region (see Plate 1).

## STRUCTURE OF PART 1

Chapter 1 gives an overview of the Nepal setting in which MUS projects[3] were built along with a brief history of the country and relevant issues of poverty and development for smallholders in the middle hills. It also describes the basic structure of government departments concerned with water resource development. Chapter 2 describes the major stakeholders in the MUS project in Nepal, the project approach, major components, and process overview. Chapter 3 presents the case study of Chhatiwan, a single-tank, one-line distribution system with abundant water supply. Chapter 4 describes the case of Senapuk village, a double-tank, two-line distribution system with moderate water supply. Krishnapur case study comprises chapter 5, a water-scarce village with homestead storage and an "all but drinking water" MUS. Chapter 6 draws lessons and conclusions from the three case studies and is augmented with additional information about the role of SIMI staff and other Nepal MUS projects. Chapter 7, the final chapter on Nepal, covers the Learning Alliance process undertaken to expand the concept of MUS and an analysis of the scope for scaling up MUS work in the country.

## SELECTION OF CASE STUDIES

While every MUS scheme in Nepal provides unique insights for the approach globally, three cases from different districts (marked on Plate 1) and with different water supplies and technology development were selected as an efficient way to cover most of the lessons learned from the MUS project in Nepal. Chhatiwan Tole cluster (in Palpa District), as the water-abundant case with a single continuous-distribution system, was also the first MUS project to be built in Nepal. Senapuk village (in Syangja District), the second MUS system built in Nepal, has moderate water supply and was the first double-tank, two-distribution-line design. Krishnapur (in Surkhet District), a cluster within a water scarce village, built on-site water storage to allow flexibility of use with limited water supply. Most important, the three cases tease out important insights for further MUS implementation in Nepal and elsewhere around the world. The knowledge shared here is based primarily on site visits, informal interviews, focus groups, and interviews with staff responsible for implementation, key personnel, and leaders/elders in the villages/clusters. This study is not an impact assessment with systematic water-use and water-productivity measurement (which is now needed), but an analysis of the process of MUS implementation and concept dissemination. It lends insight for scaleup and anecdotal evidence of the potential impact MUS may have on rural smallholders' lives.

CHAPTER 1

# THE NEPAL SETTING

Photograph by Monique Mikhail.

## RECENT HISTORY OF NEPAL

The history of Nepal has been fraught with conflict. In order to understand the situation in which the MUS project implementation occurred, it is important to know Nepal's most recent history of civil war and dysfunctional government. In February 1996 one of the Maoist parties in the country started the "People's War" to establish a new democratic republic, beginning a decade-long civil war. The Maoists created their own government structure at the district level in around 70 percent of Nepal. In June 2001 Crown Prince Dipendra killed eleven members of the royal family, including King Birendra and Queen Aishwarya, and then himself, exacerbating the Maoist conflict and leaving his uncle Gyanendra the new king. In October 2002 Gyanendra temporarily dissolved the government only to reappoint another government one week later. Gyanendra again dismissed the government in February 2005 and took absolute control, supposedly in order to suppress the Maoist insurgency.

Communication, including freedom of the press, was largely stifled, and politicians were put on house arrest. Elections held in February 2006 were boycotted by the major political parties, and some candidates were even forced by the army to flee. Mass street protests and strikes in April 2006 forced into power a new seven-party coalition government (called the Seven Party Alliance), removed most of the king's power, and led Maoists to declare a cease-fire. The Seven Party Alliance began peace talks with the Maoist insurgents, leading to a comprehensive peace agreement in November 2006 and ending the civil war. An interim Parliament including Maoist representatives was instated in January 2007. In April the eight ruling parties formed an interim Council of Ministers including Maoist ministers. In September the Maoists decided to leave the interim government, demanding the monarchy be abolished and forcing the November constituent assembly elections to be postponed. In December, in order to reach a peace agreement with the Maoists and bring them back into the government, Parliament approved the abolition of the monarchy. In April 2008 elections for the new constituent assembly were held, and the Maoists won the largest block of seats. In May Nepal was declared a republic, and in July Ram Baran Yadav became president (U.S. Department of State).

## NATIONAL TRENDS

It was among this political turmoil and uncertainity that the Nepal MUS project took place. In addition, other important national trends set the backdrop for MUS implementation and Learning Alliance work.

### POPULATION PRESSURE

The population of Nepal is over 23 million and growing at 2.27% per year (Government of Nepal [1]). This population growth places pressure on the already scarce land and water resources of the region and underpins the need for careful planning and consideration of projected growth in project design.

### POVERTY REDUCTION

According to the 2006 World Bank report "Resilience Amidst Conflict: An Assessment of Poverty in Nepal, 1995–96 and 2003–04," the incidence in overall poverty fell from 42% to 31% in the past decade. However, much more significant poverty reduction occurred in urban areas (22% to 9%) than in rural areas (43% to 35%). And the prevalence of poverty among rural households with less than one ha of land remains high (40%). Smallholder farmers participating in MUS projects in Nepal all fall into this category, largely because average landholding size has decreased in the past forty years by 28% from 1.11 to 0.8 ha (Government of Nepal [2]) due to the partitioning of land to multiple sons in each generation. Furthermore, because they are more likely to have access to irrigation and better situated farms, the land productivity of nonpoor households is nearly two times higher than that of poor households (Sharma 1999).

Lack of access to irrigation is a major factor linked with rural poverty. According to the latest "Nepal Living Standards Survey" (Government of Nepal [3]), the risk of poverty is more pronounced among farm households that do not have access to irrigation. And as access to irrigation and the share of irrigated area increases, the poverty gap between farm households with and without irrigation grows. For these reasons, irrigation was identified as one of the key drivers for agricultural development in the 1995 Agriculture Perspective Plan along with fertilizer, power, technology, and agricultural roads. The Plan emphasizes the development of year-round irrigation, particularly through expanding shallow tube wells in the Terai and improving the existing Farmer Managed Irrigation Systems (Government of Nepal [4]). Matching the interest in expanding irrigation capacity, funding for irrigation has steadily increased since 1976 (Pradhan 2005). To more effectively reach the rural poor who most need irrigation access, the World Bank is supporting irrigation projects that are demand-driven and managed by local water-user groups (World Bank [1]). However, the landholdings of a large percentage of smallholders in the hill area are high above the streams and rivers and are inaccessible to the quantities of water necessary for traditional cereal-crop production.

Another critical connection between poverty and the aforementioned Maoist insurgency and decade-long civil war is the impetus for unrest. A positive correlation has been drawn between poverty levels of certain areas at the onset of the civil war and the strength of the civil conflict there (Do and Iyer 2007). In addition, the perception of intracommunity inequality of access to resources within communities influenced the insurgency (Macours 2006).

### Remittances, Migration, and Income Inequality

The aforementioned civil war encouraged many to seek work overseas, which dramatically increased remittances, accounting for one-third to one-half of the overall poverty-rate reduction over the last decade. In fact, in 2003–2004 remittances accounted for 12 percent of the nation's GDP. By 2003–2004, over one million Nepalese were working outside the country, mostly in India, but increasingly in the Persian Gulf and East Asia. Families also receive pensions from family members working in the British or Indian armies. Urbanization also factored into poverty reduction, accounting for roughly one-fifth of the overall decrease.

However, as families migrated and shifted to working abroad, the gap between the rich and poor widened. This problem was much more extreme in rural areas, particularly in the Midwest and Far West regions of Nepal (see Plate 1). Caste negatively influences the poverty status of Dalits and Janjatis (lower castes) in the middle hills. While these groups have experienced some poverty alleviation over the past decade, the rate of decline in poverty was much less than that of the Upper Castes and Newars in the same areas (Macours 2006).

As might be expected, the shift of the male population to working abroad is affecting women. Wives of migrant workers take on more responsibility than their counterparts, and poverty in female-headed households tends to be lower than the average, due to remittances. While this has empowered some women, migration is not always a positive influence. If the woman continues to live with her husband's extended family after he leaves the country, money is often sent directly to his parents, leaving her subservient to them (Macours 2006).

## HEALTH AND DOMESTIC WATER SERVICES

A countrywide push toward increased health-facility coverage and road expansion has generated some positive health outcomes in the last decade. Child mortality dropped 5 percent each year, largely due to immunization and increased disease prevention and treatment (World Bank [2] 2006). Access[1] to domestic water services has also improved, although it remains a significant health concern. According to the UNICEF/WHO midterm assessment of Millenium Development Goals, 82% of rural Nepalis have improved access to drinking water, although only 8% have household taps, and only 20% of rural residents have access to sanitation facilities. The percentage of households with access to a tap or pipe (not necessarily a household connection) in the three case-study districts is fairly high (see Table 1.1). Despite these positive changes, it is recognized that more must be done to provide domestic water access. The World Bank is giving loans for projects that reduce water collection time (World Bank [1]). More specifically, they have initiated a Rural Water Supply and Sanitation Project that seeks to further institutionalize the "Fund Board" approach and support community-based user groups, pledging $41.5 million to this effect (World Bank [3]).

**Table 1.1: Access to different types of water sources in the three case-study districts**

| District | Total Households | Tap/ Pipe | Well | Tube Well | Spout Water | Rivers/ Stream | Others | Not Stated |
|---|---|---|---|---|---|---|---|---|
| National | 4,174,457 | 52.9% | 9.0% | 28.4% | 6.4% | 1.5% | 0.9% | 0.9% |
| Palpa | 49,942 | 84.7% | 6.8% | 0.3% | 6.0% | 1.0% | 0.1% | 1.2% |
| Syangja | 64,746 | 81.4% | 11.8% | 0.0% | 5.2% | 1.0% | 0.0% | 0.6% |
| Surkhet | 50,691 | 69.1% | 11.3% | 0.0% | 11.3% | 4.9% | 0.8% | 0.8% |

Source: Geeta 2006.

## CONSUMPTION PATTERNS, MARKET DEMAND, AND ACCESS

Food insecurity is a real problem for many households in Nepal, and child malnutrition in the country still ranks among the highest globally (World Bank [2]). The agrarian Nepal culture emphasizes that a farmer should grow all the food necessary for household consumption, with the need to purchase only salt, sugar, and cooking oil. Therefore, diets have historically consisted largely of cereals and tubers. For example, from 1996 to 1998 the people of Nepal obtained 80 percent of their diet from cereals and tubers alone (FAO 2001). Vegetable consumption primarily comprised a few rain-fed vegetables scattered near the homestead (cauliflower, radish, cabbage, or mustard) and *gundruk*, which is made by fermenting and then drying the leaves of these plants, eaten during the winter months. Expenditures on vegetables have generally been low: in 1996 they spent only 14.6 percent of their total food expenditure on fruits and vegetables (Seale et al. 2004).

Yet, vegetable consumption is rising. From 1994 to 2003 vegetable consumption per capita rose by 34.7 percent.[2] And although 97 percent of vegetable production is domestic, imports are increasing, with a good quantity of the vegetables traded at local markets coming from Indian traders. These factors suggest two opportunities for Nepalese farmers: capturing the market supplied by Indian vendors and servicing the expanding new vegetable markets of Nepal. But, many Nepalese farmers do not have easy access to markets. In Nepal, only 36 percent of the rural population has access to all-weather roads (World Bank [4]). Currently the Nepali government spends about 1.8 percent of its GDP on transportation, but new World Bank funding for the Road Maintenance and Development Project (which is working to improve access to more remote areas in the country) and a grant to the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) is assisting decentralized local agencies to develop and manage rural roads (World Bank [4]).

## SITUATION OF THE MIDDLE HILLS

### LAND CLASSIFICATION

Even considering pensions and remittances, agriculture remains the major economic activity in the middle hills of Nepal. Land is classified into three basic types, depending on the type of crops that can be grown on it: Since rice is the primary crop for the Nepalese, the most important land is *khet*, which is terraced with bunds for growing rice and is commonly the only land that is irrigated (often with Farmer Managed Irrigation Systems). *Bari* is sloping land that is sometimes terraced to reduce the slope and generally is not irrigated but is used to grow all types of rain-fed crops. The steep slopes and wasteland is called *kharbari* and is used for growing fodder and thatch.

Use of bari and khet is based on location in relationship to the homestead —bari close to the homestead can more easily be used for vegetables that require protection from predators and pilferage. Khet close to the homestead is more likely to be used for potatoes or other vegetables in the dry season if it is close enough for easy access since more labor is required than for traditional cereal crops. Bari is the most prevalent land type in the middle hills region. And despite a lack of access to canal irrigation, it has great potential for increased crop growth with microirrigation because the technology can be used on sloping land without danger of erosion. For this reason, the productive portion of the MUS projects in Nepal took the form of microirrigation of vegetables on bari land close to the homestead.

### ACCESS TO WATER

In the middle hills, snow melt is largely inaccessible because rivers draining it have cut deeply into the valleys and are usable only with very long canals or by pumping, which is often prohibitively expensive. Because of this, spring water has become the preferred source of domestic water for all villages. In many cases the discharge from springs is seasonal, and where their water is captured for domestic use, these springs no longer feed into the streams. Domestic uses include drinking, cooking, utensil washing, bathing, house cleaning, toilet flushing, and livestock watering. Households also prefer to use tap water for clothes washing except when (as at festival times) there are too many loads of wash for the available water. At these times they go to the nearest spring or stream to wash clothes. If households have many animals, they may take the animals to the stream to drink also.

Most irrigation water in the middle hills comes from small rain-fed side streams. These have seasonally high discharge variability and may have no water in the premonsoon dry season. With sufficient irrigation water and short-season varieties, three crops of cereal can be grown in a year (one per season) at elevations below 6,000 feet and two crops per year at higher elevations. However, many households, and often entire village communities, have no access to irrigation and are primarily dependent on rainfall for their crops.

The highly variable seasonal rainfall patterns heavily influence both the availability of domestic water and the growing seasons of Nepal and are the major complicating factor for MUS project settings. The settings described in one season could change completely in another season as well as from one year to the next. However, the variability also makes irrigation in the premonsoon and postmonsoon seasons highly attractive to farmers, both for sustenance and because produce garners higher prices during the off-season.

The three recognized seasons in Nepal are based on the monsoon: premonsoon (or “dry season” from March to mid-June), monsoon (or “rainy sea-

**Table 1.2: Rainfall and temperature pattern approximation for case studies**

| Season | Months | Average Temperature Range (° C) | | Average Evapotranspiration (mm/day) | | Percentage of Rainfall | |
|---|---|---|---|---|---|---|---|
| | | Tansen (approx. for Chhatiwan & Senapuk) | Surkhet (approx. for Krishnapur | Tansen (approx. for Chhatiwan & Senapuk) | Surkhet (approx. for Krishnapur) | Tansen (approx. for Chhatiwan & Senapuk) | Surkhet (approx. for Krishnapur) |
| **Premonsoon** | March to mid-June | 16–28 | 10–36 | 4.5 | 5.4 | 15% | 15% |
| **Monsoon** | mid-June to Oct. | 19–27 | 16–36 | 3.4 | 3.9 | 78% | 81% |
| **Postmonsoon** | Nov. to Feb. | 6–19 | 3–24 | 2.1 | 2.1 | 7% | 4% |

Source: FAO CROPWAT data for Tansen, located 20 km southwest of Senapuk and 10 km northwest of Chhatiwan, and Surkhet, located six km southwest of Krishnapur.

son" from mid-June to October), and postmonsoon (or "winter" from November to February). Rainfall and temperature data for the three case-study sites are good examples of the disproportionate distribution of rain in the three seasons (see Table 1.2 and Figure 1.1). The area around Tansen (representative of Chhatiwan and Senapuk) receives around 1800 mm (approximately 71 inches) of rainfall per year, while the area around Surkhet (representative of Krishnapur) receives around 2200 mm (approximately 86 inches) annually.

## CROPPING PATTERNS

Figure 1.1 shows the rainfall patterns at the two climate stations nearest to the three case studies as well as the traditional cropping pattern on khet land in the middle hills of Nepal. From IDE staff experience, a khet field of 0.4 ha will yield about 2,000 kg of paddy (unhusked rice), 2,000 kg of maize, and 500 kg of wheat per year.

### Cropping During the Premonsoon Dry Season

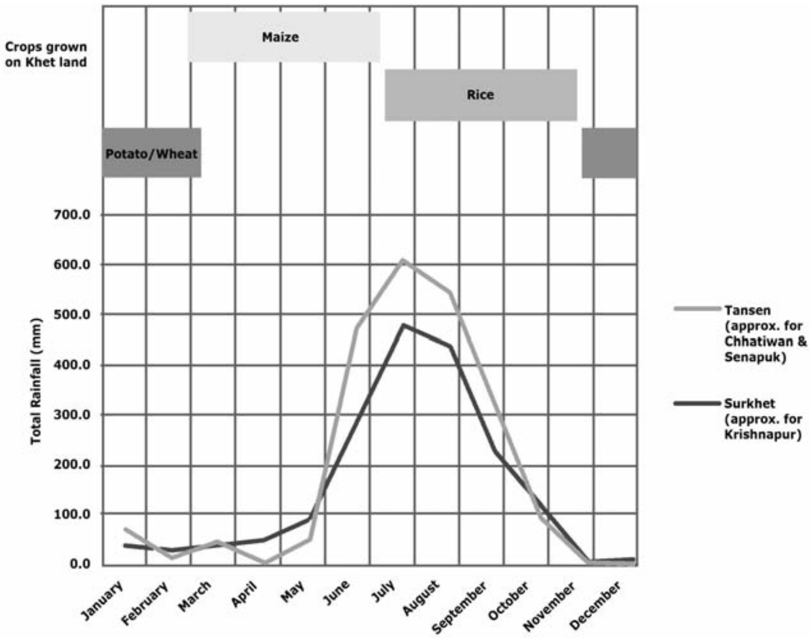
The hottest time of year with most solar radiation is the season prior to the monsoon (dry season). While around 15 percent of rainfall does occur in this period, it is in the form of unreliable thundershowers. If the nearby stream has sufficient water for irrigation, rice can be grown on khet land in the dry premonsoon season. However, this is often not the case, so traditionally there has been no attempt to grow irrigated paddy on khet land in the premonsoon season. Instead, a short-season maize is planted (increasingly using hybrid varieties), and if the distribution of rain showers is reasonably uniform, production is good. If it does not rain at the time of optimal maize planting (in March or early April), the fields are generally left fallow or lentils and other crops that require less water are planted. On bari land, a long-season maize is generally planted in March or April if there is a good soaking rain. This crop is harvested late in the rainy season. If irrigation is available for bari land, vegetable production becomes possible, extending the cropping intensity of bari land to three crops per year. Recently, garlic, onions, and chili peppers have been taken up as cash crops grown on bari.

### Cropping During the Monsoon Rainy Season

Since most of the rainfall occurs in the monsoon season, it is the peak cropping period. Recently the trend has been to use small spring-fed streams as the major source of irrigation water. Where these are available, they are generally used to grow rice on khet land. The bari fields near the houses in the village are used to grow rain-fed maize intercropped with beans during the monsoon season.

Fruit and vegetable cultivation is traditionally subsistence, with a small percentage of farmers periodically selling a few vegetables in the market.

**Figure 1.1 Rainfall and typical cropping patterns on khet land**




Created using FAO CROPWAT data for Tansen, located 20 km southwest of Senapuk and 10 km northwest of Chhatiwan, and Surkhet, located 6 km southwest of Krishnapur.

Farmers generally do not irrigate vegetables but simply cast a few seeds near their households and let them grow with minimal cultivation effort.

### Cropping During the Postmonsoon Winter Season

Even though only around 5 percent of rainfall occurs in the postmonsoon season, residual moisture from the monsoon period and low evapotranspiration due to mild temperatures allow farmers to cultivate some crops in this season. While the temperature is optimal for growing wheat, and residual moisture at sowing time is good, lack of rainfall limits the productivity of wheat cultivation. Wheat or mustard were traditionally planted on the bari, but due to a decrease in wheat prices potatoes or garlic/onion crops are gradually replacing wheat in the postmonsoon season.

## LIVESTOCK

All households in the villages of the middle hills generally have livestock, including buffaloes, cows, and goats; some villages also raise poultry and pigs. Livestock contribute meat and milk to local families' diets, and sale of *ghee*[3] and meat contribute to their cash income. However, the quantity of cattle/bullocks is decreasing in Nepal for a few reasons: First, landholding size is decreasing, so there is less need for animals to aid in cultivation. Second, there has been an increased interest in high-yield animal breeds, requiring a fewer number of animals to produce the same amount of milk and meat. Third, a lack of available land for fodder has limited cattle/bullock production to some extent. However, poultry, goat, and hog production has increased, in part because of the government's encouragement as part of their poverty-reduction strategies.

In this area of Nepal two livestock-feeding systems are most often used: sedentary and stall-fed. In the sedentary system, livestock graze around the perimeter of the village during the day and return to the village in the evening. Livestock is also sometimes grazed away from the village; however, restrictions can limit this (Cooke 2000). Where all land is cultivated, animals are not allowed to graze. Goats are generally kept in the house or in a shed to keep them away from crops during cultivation. So grazing away from the village mainly applies to cattle, buffalo, and goats and includes foraging in the forest and on postharvest cultivated land and fallow land. The animals feed on crop residues from paddy, maize, millet, wheat, mustard, soybean, and vegetables; grasses; and tree fodder from both forest trees and those owned by the farmer (Pariyar).

The stall-fed system is more often used when there is limited community land for grazing and when the area is too steep. It is rare for households to utilize any of their small land area for fodder production, so stall feeding is often practiced in areas of intensive cultivation with three crops per year where there are generally enough by-products to feed the livestock. If there are not enough crop by-products, families cut grass, leaves from trees (including the species Ficus semicordata, Garuga pinnata, and Erythrina arborescens), and any other fodder they can collect from the nearby forests. They also sometimes make a cooked gruel of oilseed cake, straw, and water, called *kundo*.

Livestock watering in Nepal is considered part of domestic water allocation; if the domestic water supply is sufficient and nearby, a family will collect water from it to water their livestock. However, the domestic supply is often inadequate for all domestic needs. If such is the case but an irrigation supply is nearby, households will bring water from the irrigation canal for the animals. If the irrigation supply is further away, families will take their animals to drink from the irrigation canal. If there is no water supply infrastructure, but a stream is available, households will take the livestock to the stream once or twice per day to water. If there is water scarcity and none of the above options are available, households will move the animals to a separate location. In this instance a small group of families will jointly build a corral for their livestock and have a few boys from the families stay there to take care of the animals.

## GOVERNMENT STRUCTURE

Although multiple-use services projects in Nepal were implemented by the communities and NGO partners, various government organizations provided both financial and in-kind contributions and technical training. In order to understand the role that the government played in the MUS project in Nepal, it is necessary to understand the government structure and present water resource development situation.

### LOCAL GOVERNMENT

In Nepal the smallest political division is the ward. Nine wards make up a Village Development Committee (VDC), which is an administrative-political structure but can also refer to an area of political designation. It is the most local governing body in Nepal, and membership is based on the population density of the area. The formal governing body of a VDC has traditionally been a 13-person Village Development Council headed by a chairman, vice-chair, and secretary. However, with the recent political upheaval, the current VDC leader is the VDC secretary, who is appointed by the Ministry of Local Development.

### DISTRICT AND REGIONAL GOVERNMENT

The District Development Committee (DDC) is the next tier up from the VDCs. Each DDC oversees all VDCs in a district and is headed by the chief district officer, who is responsible for maintaining law and order and coordinating the work of field agencies of the various government ministries. After the enactment of the Decentralization Act in 1982, the DDC became responsible for all district development activities including irrigation and small-scale water supply and sanitation (where the population was under 1,000). This decentralization of government services such as education, primary health care, and rural road maintenance has transferred some power to the district level (World Bank [2]).

DDCs receive technical support from the District Technical Office (DTO), which is overseen by the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) under the Ministry of Local Development at the national level. DoLIDAR is meant to coordinate directly with other line agencies such as the Department of Irrigation (DoI) and the Department of Water Supply and Sewerage (DWSS). The Department of Irrigation also has district-level offices that coordinate with the DDCs.

There are several governmental organizations involved in assisting farmers with agricultural services. These include:

- District Agriculture Development Office (DADO)
- District Livestock Services Office (DLSO)
- Agriculture Service Center (ASC)
- Livestock Service Center (LSC)

DADO and DLSO are both district departments within the Ministry of Agriculture and Cooperatives. They have offices in each district headquarters. ASC and LSC are like extension agencies, each servicing around four or five VDCs. They are responsible for disseminating information to farmers through demonstrations and other knowledge sharing. However, on a day-to-day basis DADO, DLSO, ASC and LSC provide little support for farmers, although they occasionally provide some technical assistance.

There are a total of 75 districts in Nepal which make up 14 administrative "zones" that are grouped into five development regions—Far Western, Midwestern, Western, Central, and Eastern (see Plate 1). These zones are more of a regional demarcation than political boundaries.

## NATIONAL GOVERNMENT

The major national-level ministries with involvement in multiple-use services projects are the Ministry of Water Resources, the Local Development Ministry, the Ministry of Physical Planning and Works, and the Ministry of Agriculture and Cooperatives. The DoI falls within the Ministry of Water Resources while the DWSS is housed within the Ministry of Physical Planning and Works. The Department of Agriculture is under the Ministry of Agriculture and Cooperatives (see Figure 1.2).

The DWSS is largely concerned with urban water and sanitation development but operates in conjunction with the Rural Water Supply and Sanitation Fund Development Board (called the Fund Board) on rural water supply and sanitation services. The Fund Board was created in 1996 to promote sustainable and cost-effective demand-led services in order to reverse the trend of lagging services. It operates predominantly through NGOs and community-based organizations (CBOs) at the local level to emphasize community ownership.[4] The NGOs/CBOs act as contractors with terms and conditions established formally at the national level. Therefore, partnership cannot be built at the district level if it is not explicit in the national-level contract.

The Fund Board, funded by the World Bank and the UK Department for International Development, is supervised and managed by seven board members comprising joint secretaries, one each from the Ministry of Physical Planning and Works and the Ministry of Local Development; one from the Association of District Development Committees of Nepal and one from the Association of Village Development Committees in Nepal; two professionals representing the nongovernment sector; and one professional representing the private sector. All of these board members are nominated by the central government for three-year terms. The chairperson of the Fund Board is elected by the members for a three-year term. While the Fund Board is largely focused on domestic water, there has been recent interest in microirrigation and MUS systems. (This interest is described in chapter 7—"Applying the Learning Alliance Approach".) See Figure 1.2 for a general lay-out of the government organizations involved either directly or indirectly with domestic and productive water policy and implementation in Nepal.

## GOVERNMENT WATER-DEVELOPMENT SITUATION

The Water Resources Strategy of 2002 guides all water resource projects in Nepal. Two of the ten goals the Strategy recommended are:

- Adequate supply of and access to potable water and sanitation and hygiene awareness provided
- Appropriate and efficient irrigation available to support optimal, sustainable use of irrigable land

Working toward achieving these goals is the responsibility of multiple government agencies.

### RESPONSIBLE AGENCIES

Guided by the Strategy, the overarching agency that controls water resource projects in Nepal is the Ministry of Water Resources. Implementation is through the National Water Plan, run by an interministerial coordinating committee comprised of the National Water Resources Development Council, Water and Energy Commission, and National Coordination Secretariat. The National Water Resources Development Council and Water and Energy Commission Secretariat set policy and coordinate nationally with DoLIDAR, the Fund Board, and DoI, the agencies that are largely responsible for project implementation. They also operate through regional and district water and sanitation subcommittees, which interface with the DDCs, VDCs, NGOs and local community groups including Water User Associations (WUAs). With a mandate from the irrigation component of the National Water Plan, the DoI started a program in 2003 to promote the development of nonconventional irrigation technology schemes including microirrigation.

### WATER RIGHTS

Water rights in Nepal are administered under customary rights and statutory laws. Customary rights adhere to land ownership of the abutting stream or river; if the source is on public land and is being used by a group, particularly for drinking water, the source is considered to be community property. If the source is on private land, it is considered to be private property. The practice of protecting a source from encroachment by erecting a statue or temple near the source still exists, and if a source is in forested land, the forest is protected, with penalties for anyone who attempts to damage the source quantity or quality (Gautam 2006).

On the other hand, the Water Resources Act of 1992 established the government as the owner of all water resources of the country and contained three separate regulations: drinking water supply, irrigation, and ground water. Within the Water Resources Act, priority is given to domestic water with irrigation having secondary status followed by other uses (Gautam 2006).

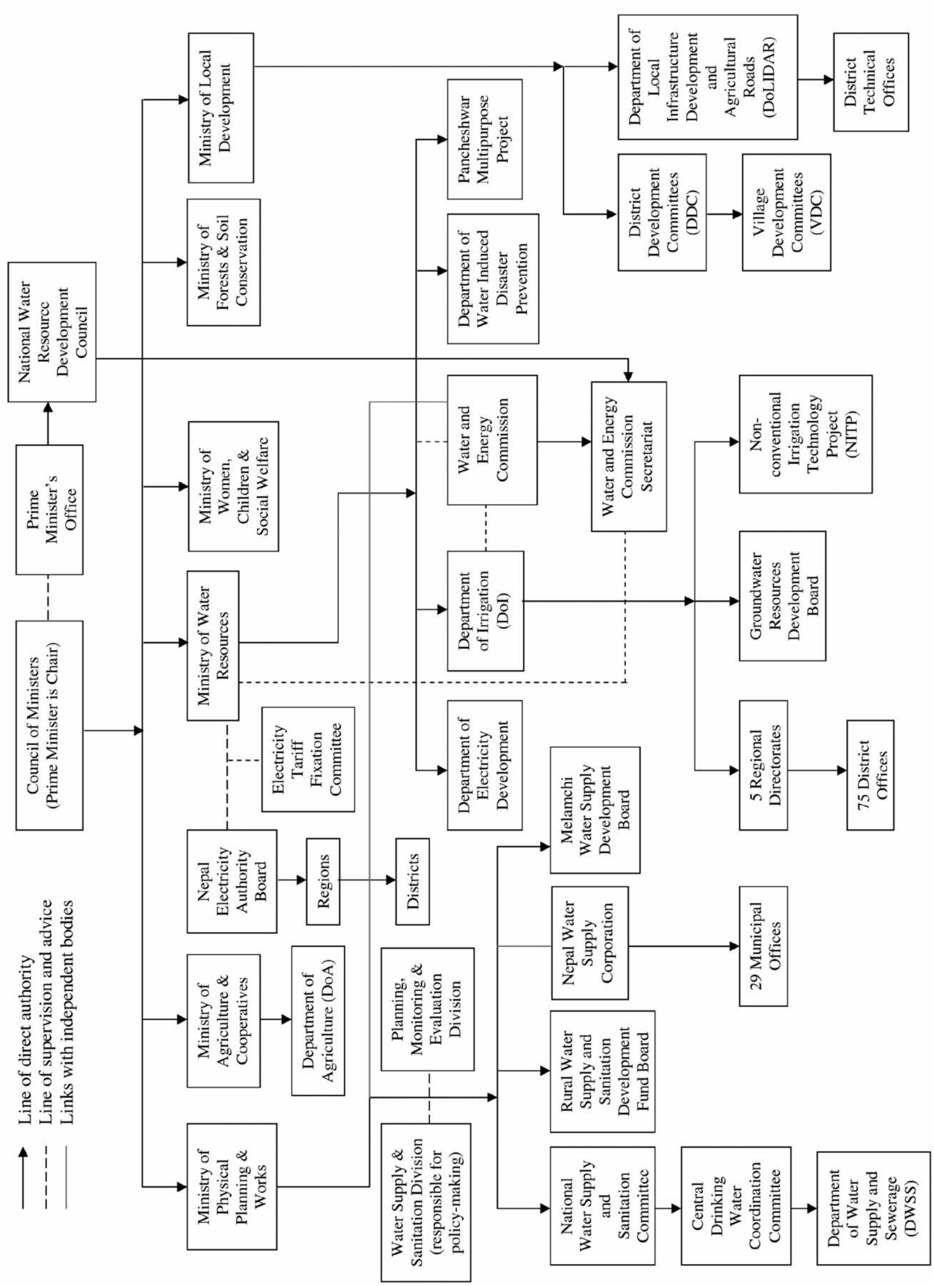
It is the tension between the statutory laws and customary rights that leads to confusion about source registration and use rights. The Water Resources Act gives power to the district level over user licensing and resolution of water disputes. The registration of water rights for irrigation, drinking water, hydropower, and other commercial uses is the authority of the District Water Resources Committee (DWRC) chaired by the Chief District Officer with the Local Development Officer and all office chiefs dealing with water resources development comprising the rest of the committee. The DWRC is required to use prevailing local norms to guide their licensing and dispute-resolution actions including (Gautam 2006):

- Priority of drinking water over other uses;
- Prior appropriation;
- Upstream users must not adversely impact preexisting downstream users;
- Mutual contracts or agreements to share a water source can be made among groups of users;
- An agreement can be made between two groups of users such that one group can permit a second group to use its water allotment with receipt-of-labor contribution, Operation & Maintenance fund contribution, or other mode of payment;
- Water-rights dispute resolution must be attempted by the user groups themselves prior to involvement of the DWRC.

The Water Resource Act also established a status for Water Users Associations (WUAs) as autonomous corporate bodies having perpetual succession. The WUA can own a project while the district government remains the owner of the water source itself. The WUA has legal authority to collect annual fees as established by the district and can stop services for default on payment (Gautam 2006). The DWSS proposed the idea of registering the right to a source through WUAs based upon each separate use, and some groups do this. However, registration with the DWRC is more legally binding.

Furthermore, registration of a group is different from registration of a water source, although they can also be combined. For registration of both together, users need to first develop a constitution to create a formal Water User Association and then get a recommendation from the VDC. The VDC recommends to the DWRC that the registration of the source belong to the WUA. The DWRC contacts the District Irrigation Office or drinking water and Sanitation Office for their recommendation of use. Based on their recommendation, the WUA is registered with the source for only one purpose—drinking water or irrigation.

**Figure 1.2 Organizational structure of government bodies dealing directly or indirectly with domestic and productive water in Nepal**




Courtesy of Monique Mikhail

On the other hand, a group of farmers that organizes as a production group, not as a Water User Association, can register a source under its group name with the DDC but will not be considered a formal registered Water User Association. Most of the MUS projects in Nepal were registered in this way by using the name of the production group they had previously formed. Some groups that registered with the DADO as formal agriculture groups were required to additionally register the source through the DDC to obtain formal rights for its use. To make matters even more complicated, if the DoI contributes over NPR 500,000 ($7,143) for a particular scheme, then the user group must also be registered with the DoI.[5] Although registering as a legal entity allows the group to have a bank account and more assured use of the source in the future, this confusing setup and involvement of multiple government entities is a formidable challenge for smallholder farmers who do not have the time or the experience to effectively deal with these types of legal procedures.

Compounding convoluted registration practices, the Maoist insurgency removed the existing government oversight and support structure during the civil war and replaced it with Maoist mandates. Natural-resource user groups including Water User Associations remained some of the only functioning democratic institutions during the conflict and provided a crucial function for rural communities. NGO projects adjusted to enable continued work with these groups, and the groups themselves adapted by holding fewer meetings and restricting their management activities (Schweithelm et al. 2006).

CHAPTER 2

# PROJECT OVERVIEW

Photograph by Bimela Colavito.

## PRIMARY PROJECT STAKEHOLDERS

Communities were the focal point of MUS project work, but involvement of other organizations was critical. Some organizations contributed financially, with in-kind donations, or technical assistance and were also influenced by project involvement. Others provided essential information about communities when SIMI was searching for communities to work with. For a more in-depth look at project partners and the evolution of their involvement in MUS, see chapter 7.

### COMMUNITY MEMBERS — CLUSTER OR VILLAGE

During implementation of MUS projects in Nepal, SIMI worked with both whole villages and clusters within villages. A cluster can be either a grouping of households that are physically separated from other groupings of households within the village or an ethnic/caste grouping of households within a village. Both Chhatiwan and Krishnapur are examples of clusters that are physically separated from other groups of households within their village. While Chhatiwan is separated by hilly terrain, Krishnapur is separated by the fact that they all use the same branch of the village's canal irrigation system. Senapuk, on the other hand, is an example of a whole village (36 households) that SIMI worked with to construct a MUS scheme. Throughout this document "community" is used as a general term to signify a group of people and could apply to a cluster or village.

### WATER USER COMMITTEE (WUC)

When SIMI begins working with a community, the community is required by the agreement to register use of the source (registration is explained in the "Water rights" section of chapter 1) and be recognized as a formal entity. Once it is registered, the community can set up a bank account in the user group's name and receive loans and/or material assistance from agencies such as DoI and DoA for its MUS system. Many of the communities that SIMI works with in Nepal have already organized themselves into production groups and often register under their groups' names. Sometimes these groups simply transition into the construction committees, and they sometimes hold new elections. Subcommittees of the construction committees are created for various tasks — site selection, water resources capacity measurement, selection of pipe route, and selection of sites for constructing hybrid tapstands, offtakes, and tanks. Upon completion of project construction, the committees either transition directly into Water User Committees (WUCs) or reelections are held. The WUCs are responsible for operation and maintenance, setting allocation rules, and mitigating any disputes over use that may arise. SIMI recommends a gender composition of at least one-third female for the committees, but not all groups necessarily follow this recommendation.

## LOCAL ORGANIZATIONS

Local NGOs and community-based organizations are also involved in MUS projects. SIMI staff will often approach local NGOs working in a new area to determine which communities would be best to work with and to make inroads with these communities. And in districts where SIMI is applying the NGO model function (explained below) these NGOs may actually become partners in direct MUS implementation. In other cases, local NGOs or community-based organizations (e.g. Community Forestry Groups, community clubs, and cooperatives) will contribute funding for a project. And in some cases local schools financially support MUS systems in order to obtain drinking water for students and sanitation facilities.

## INTERNATIONAL ORGANIZATIONS

IDE and Winrock partnered on all the programs through which multiple-use services were implemented in Nepal including the programs of SIMI, BDS-MaPS, and Ujyalo. IDE/Winrock also partner with other international NGOs on MUS projects including World Vision Nepal, Helvetas, and CARE. Through these partnerships the international NGOs support MUS projects financially and with materials, whereas IDE handles technical assistance with the help of local NGOs and community-based organizations.

## GOVERNMENT

Among the local and national government agencies, it is mainly the VDC that provides a supportive role in MUS project implementation. At the inception of each project within an area, SIMI calls a meeting and invites the leaders of five or six area VDCs. They explain the project to the VDC leaders who then discuss it in their respective villages. Those who are interested come back to SIMI with affirmation that they wish to implement a project in their villages.

However, the DDC is becoming increasingly involved in MUS projects, particularly considering the decentralization effort to shift control of development work to the district level (see chapter 7, "Applying the Learning Alliance Approach", for a more detailed discussion of this). District offices of various line agencies have contributed both materials and money to support MUS projects, leaving the planning and implementation up to SIMI staff, VDCs, and construction committees. They also provide technical assistance and training support for some schemes. The DADOs are the most active district-level line agency contributors to date.

At the national level, the Department of Irrigation through the NITP is the most substantial contributor to MUS schemes. Government bodies in charge of rural drinking water infrastructure (largely DoLIDAR) are just beginning to be involved.

## MUS APPROACH

IDE takes a value chain approach to improving smallholder livelihoods, and MUS projects are no exception. IDE connects smallholder farmers to input suppliers, including manufacturers of microirrigation technologies, works with manufacturers to train them on microirrigation technology production and encourages retailers to supply the equipment in regional hubs where smallholders can access them. The farmers are then trained on production of high-value crops and connected to markets for crop sale. It was within this approach that the conceptual evolution of MUS in Nepal began.

### BEGINNINGS OF IDE/SIMI INVOLVEMENT WITH MULTIPLE-USE SERVICES

Prior to the initiation of SIMI, IDE/Nepal had worked on connecting farmers with inputs including the provision of microirrigation technologies, capacity building on high-value crop production, and connection to markets for sale of the products. However, IDE/Nepal had not previously been involved in developing water sources for farmers. Roughly three quarters of the farmers who purchased microirrigation kits used water from their existing drinking water systems for irrigation of kitchen gardens near the water taps. However, this was limiting because the drinking water systems were not designed to provide enough water for irrigation. And the difficulty of carrying sufficient water from the public tapstands led to underirrigation of crops and lower yields than desired. In some cases the farmers augmented the supply of water for irrigation by using household wastewater. But IDE/Nepal engineers realized that they needed to incorporate irrigation need into the design and match water resource development with irrigation needs.

A meeting with the entire IDE/Nepal technical team was held in July 2003 to discuss the best way to develop water resources for irrigation. They decided to borrow ideas from gravity-flow domestic water systems in the hills and, using the WATSAN drinking water design program, designed a similar irrigation system. Some technical staff realized that if they built a hybrid domestic water irrigation system, not only would it provide much-needed domestic water, but it would also enable the expansion of microirrigation technology use and save precious water collection time that could be used for vegetable cultivation. As a comparison trial, they designed two systems in neighboring villages—one just for microirrigation (Gaptung) and one hybrid domestic water/irrigation scheme (Chhatiwan), both using a single-tank, one-line distribution system. Although both villages had positive results, the response from Chhatiwan was better. SIMI chose another village (Tori Danda) in a neighboring district to try building another MUS system, but conflicts arose over the source, so implementation was halted. Next they chose the village of Senapuk and started construction there, ultimately coming up with the first double-tank, two-line distriution system. After construction in Senapuk began,the conflict in Tori Danda was resolved and SIMI chose to build their system in a similar fashion to the one in Senapuk. After successful implementation in these two villages, IDE staff was so pleased with the results that the hybrid concept was adopted for all SIMI districts. This was the beginning of MUS system design and construction in Nepal by IDE and partners. A few other organizations, such as NEWAH, had previously designed rural drinking water systems that included livestock needs and a small percentage of extra water for "other uses," which villagers were using for kitchen gardens. However, their systems were predominantly designed for domestic purposes, and productive use was considered an acceptable "extra." NEWAH systems are by design "domestic plus" whereas the new hybrid systems were designed specifically for domestic and productive purpose, making them the first "MUS by design" systems in Nepal.

Once MUS began, IDE-Nepal used their existing programs to expand, improve, and test new methods for both MUS implementation and scaleup. These included Ujyalo, BDS-MaPS, and BDS-MaPS PRIME as mentioned in the Introduction above. By the end of 2008, 81 MUS systems had been designed and built in the middle hills of Nepal, servicing anywhere from 10 to 200 households. Due to the lack of sufficient project funds, it was very difficult to construct schemes of more than 200 households, restricting the size of MUS and the communities IDE was able to work with. Out of these systems, about half are single-tank, one-line distribution systems, and half are double-tank, two-line distribution systems. Krishnapur (chapter 5) is the one system that uses homestead storage in addition to their single-tank, one-line distribution system.

It was in this way that water source development became one component of the SIMI project in Nepal. The other components remain microirrigation, rainwater harvesting, and water storage for irrigation. Although these other components are sometimes combined with MUS, in villages where MUS is not being implemented, either harvested rainwater or surplus water from preexisting drinking water schemes is collected in tanks and used for microirrigation. In some projects solely microirrigation is promoted, and it is left up to the community to determine how they access water for this purpose; these communities largely have sufficient domestic water available. Rainwater is used mainly as supplementary water since collection during the monsoon season is not enough to supply year-round needs. The first option for MUS schemes is always the rehabilitation of the existing domestic water scheme that is either no longer in operation or has insufficient supply. If there is no system already available, MUS schemes construct entirely new infrastructure by tapping a previously untapped water source and piping it to the village for multiple uses. In one case (Krishnapur, chapter 5), water from a branch canal of a farmer-managed irrigation system was combined with a spring source. SIMI uses two different models of operation for MUS:

- SIMI direct implementation—this is being done in seven districts (all three of the case-study schemes were built through this model).
- The NGO model—a contract is signed between SIMI and a local NGO to implement.

## MUS TEAM STRUCTURE AND OPERATION

SIMI operations are headed up by a national team comprised of staff from both IDE and Winrock International and guided by the Advisory Board. The SIMI Advisory Board is officially recognized by the government and has representation from the Ministry of Agriculture and Cooperatives, Ministry of Finance, Ministry of Women, Children & Social Welfare, Ministry of Local Development (within which DoLIDAR is housed), Department of Agriculture, Department of Irrigation—Nonconventional Irrigation Technology Project (NITP), National Agriculture Research Council, Agro Enterprise Centre, SAPPROS, CEAPRED, IDE/Nepal and Winrock International.

However, it is at the district level that most of the implementation occurs. The district teams are comprised of the following positions:

- District Manager—responsible for overseeing and coordinating all district-level SIMI activities.
- Agricultural Technician—responsible for providing technical support on production techniques to community members.
- Irrigation Technician—responsible for conducting the feasibility study and survey for MUS as well as providing technical support for microirrigation technology promotion including installation, operation, maintenance training, construction supervision, and supply-chain development.
- Marketing Supervisor—responsible for organizing local marketing committees and ensuring market connectivity of smallholder farmers.
- Social Mobilizer—responsible for mobilizing community participation; SMs are usually from the district they work in.
- Community Mobilizer—responsible for mobilizing community participation; CMs are usually from the community they work in.

In the districts where the direct-implementation model is used, SIMI has one District Manager and one Irrigation Technician for the whole district. Each pocket within the district has an Agriculture Technician and Marketing Supervisor.[1] And each VDC has a Social Mobilizer/Community Mobilizer. Social Mobilizers and Community Mobilizers assist the Water User Committee with all project activities at the group level. This includes facilitation of monthly meetings, provision of information on service providers, education on seasonal agricultural activities, selection of households for demonstrations, and encouraging uptake of new technologies. The Social Mobilizer/Community

Mobilizer also responds to any small problems or conflicts the community has during the process. For example, if there is a problem with obtaining seeds or spare microirrigation technology parts, they will work with the community to manage solutions. If a larger problem arises, the community will approach the Social Mobilizer/Community Mobilizer and together they will access the respective district team member for assistance. For example, for an agriculture issue they will meet with the Agricultural Technician; if the problem is with marketing, they will talk to the Marketing Supervisor; and if the problem is something technical with the MUS system or microirrigation equipment, they will meet with the Irrigation Technician.

Each Social Mobilizer/Community Mobilizer works with around 17 user groups, visiting older groups less and newer groups more frequently. During preconstruction and construction phases, the Social Mobilizer/Community Mobilizer visits the community every other day or more frequently if requested. After completion of the scheme, they visit once a week in the first two months and then less frequently.

### Direct-Implementation Model Function

In order to launch MUS activities, the central SIMI office organized an orientation for Irrigation Technicians about the MUS concept, how it could be implemented in the field, and why SIMI had chosen to incorporate MUS into its program. After this orientation meeting each Irrigation Technician explained the MUS approach to all the other staff on their district teams. Then the Social Mobilizers/Community Mobilizers shared the MUS concept with the community groups they were working with.

For each project, the Irrigation Technician is primarily responsible for all aspects of design and construction (site selection, surveying, and construction) while the Social Mobilizer/Community Mobilizer staff liase between the communities and the remainder of the district teams.

The staff meetings held at the various levels are:

- The Social Mobilizer/Community Mobilizer staff meet once a week with the Agricultural Technician and Marketing Supervisor and twice a month with the Irrigation Technician.
- In the district all district-level staff including Social Mobilizer/Community Mobilizer participate in a monthly meeting and discuss the progress and problems that have arisen. The progress and problems are communicated with the SIMI Area Office. When possible, the Area Coordinator participates directly in this district-level meeting.
- An all-area-level staff meeting is held annually with all district teams in a designated area along with the central-level staff. All comments and issues are collected and discussed and solutions sought.

- The central-level staff meet bimonthly with all Area Coordinators. Again, issues and concerns are raised and solutions discussed. Any issues that remain unsolved from the district and area-level meetings are raised at the central-level meeting as well. The Area Coordinators share the output of these meetings with district-level staff.

### NGO Model Function

In the direct-implementation model through SIMI, Social Mobilizer/Community Mobilizer staff are directly employed by SIMI, whereas in the NGO model they are employed by the local partner organization and work in concert with the remaining SIMI team. In Ujyalo, the whole district team is employed by the local partner organization. At the beginning of the project, IDE/Nepal's technical team trained the NGO technical staff on MUS, and now the local NGOs implement MUS projects.

In the NGO model all of the Social Mobilizer/Community Mobilizer staff meet in their pockets to gather ideas for the next phase of implementation. They then sit with SIMI staff to determine a set implementation plan. The local NGOs are largely responsible for performing needs assessments and identifying potential communities, social mobilization, assessment of available water resources, and helping the community find local financial resources. In Ujyalo, the whole process is handled by the local NGO staff.

### Comparison of Two Implementation Models

Although they are quite similar, there are a few functional differences between the two models. While the social-mobilization component is similar between the two, the training and follow-up provided may be different. In the direct-implementation model, SIMI staff directly trains the community, giving more clarity to what and how the technical knowledge is shared. However, in the NGO model, SIMI first trains the NGO, and then the NGO trains the community. Or if the NGO has significant prior experience, SIMI may not give the NGO all the training. Although there is less clarity in exactly what and how the information is being shared through the local NGOs, it is definitely increasing their technical capacity, as stated by SORUP.[2]

Therefore, although there is less direct control by SIMI, the NGO model may in essence be more sustainable because the local NGO is much more likely to remain working in the local area, and creation of a relationship with the community allows them to depend more on the local NGO for follow-up after project construction. In the direct-implementation model, contact with the community will last only as long as SIMI does.

However, in the NGO model, much depends on the quality of the local NGO staff. If the needs of the community require innovation and extrapolation of technical knowledge, there can be problems both ways. If the NGO is unable to innovate, the solution given may not effectively solve the problem at hand, and they will need to seek technical support from SIMI. In this case the results will only be as good as the communication between SIMI and the NGO. However, if the NGO is too radical in its innovation, there is a danger that standards will not be followed. Therefore, SIMI must walk a fine line to keep the projects on track without being overly prescriptive and allowing growth within the local NGOs. Fortunately, the local NGOs SIMI has worked with to date have been very effective and have shown great ingenuity in their work.

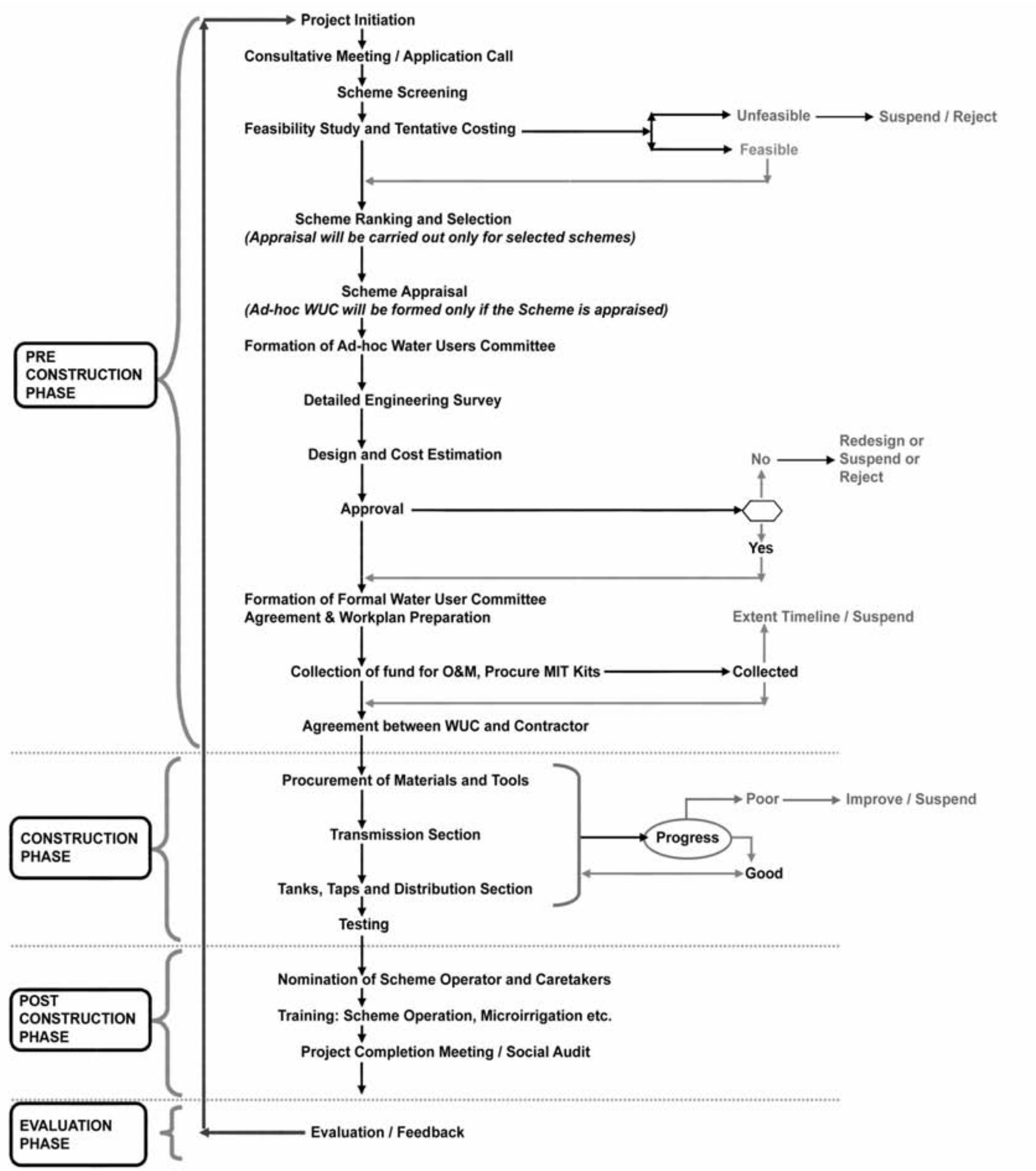
## PROJECT IMPLEMENTATION

The overall procedure for project implementation can be seen in Figure 2.1. At the onset of the SIMI project, staff divided every district where it worked into three regions called "pockets" for project selection. Annually a target number of MUS projects are planned for each pocket within every district. The district teams then obtain information from the DDC and VDCs in the district and local NGOs on these three pocket areas, requesting information on which areas have the highest priority need for water supply and which VDCs and communities are interested in a project. The team then reviews village-level data to select those with access to a market, an available water source, and evident poverty.

Once the villages that best fit the criteria are selected, initial consultative meetings between SIMI and the communities are held. Although SIMI selects and approaches each community in a slightly different way, its project agreement is based on a standard set of requirements. These requirements, clarified at the initial meeting with each community, are as follows:

- SIMI provides planning, design, and construction support limited to materials and expertise required from outside the village, such as a trained mason.
- SIMI provides various training sessions (explained in the "Trainings" section below).
- The village provides all local materials and unskilled labor for construction.
- The village is responsible for operating and maintaining the completed scheme.
- The villagers are required to establish a Water User Committee and register the group with the district government as owners and managers of the scheme. Finally, at least 75 percent of the villagers must indicate interest in purchasing microirrigation kits to use for vegetable production (see Table 2.1, appendices 1 and 2). Cost for the kits is not included in overall project costs; households purchase them independently at full cost.

**Figure 2.1 MUS project implementation procedure**




Courtesy of Deepak Adhikari.

## SYSTEM PARAMETERS

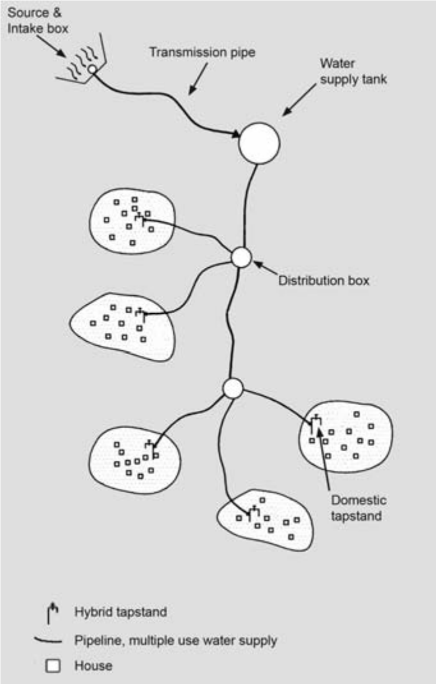
Once the initial meeting is held and the project agreement is made, the water demand is calculated using a set of parameters. Domestic demand is calculated by assuming a need of 45 liters/capita/day[3] for the projected 10-year population of the village or cluster. For irrigation demand, SIMI engineers use a range of 400–800 liters/household/day. This productive-use design requirement is based on the evapotranspiration rate in the hill region of Nepal. Taking the case sites as an example, Table 1.2 shows the premonsoon dry season evapotranspiration rate to be 4.5 mm/day for Chhatiwan and Senapuk and 5.4 mm/day for Krishnapur. The rate is 2.1 mm/day for all three case-study areas during the postmonsoon season. Experience by SIMI field staff in the Nepal hill environment demonstrated that as little as 2 mm/day/$m^2$ water-application rate will provide a good crop of vegetables in the postmonsoon and premonsoon seasons. The premonsoon dry season flow rate of the source for each system was measured against the combined domestic and productive needs to ensure enough year-round base flow for system design.

## SYSTEM COMPONENTS

After the demand is calculated and a sufficient source chosen, the system is designed. The main system components are largely the same for all MUS schemes in Nepal. Some slight variations occurred as IDE adjusted and incorporated alternate models it had been testing for storage and new designs for intake water filtration. Systems begin with source protection at the intake of the spring, and then water is conveyed by gravity through plastic pipe to one or two water collection tanks near the village. IDE tanks include the Modified Thai Jar (see appendix 3) with capacities of 1,000, 1,500, and 3,000 liters and the ferro-cement-lined tank (see appendix 4) with capacities of 6,000 and 10,000 liters. The Modified Thai Jars are made with ferro-cement (a mixture of sand and cement which is applied as a thick plaster on wire netting for reinforcement). The ferro-cement-lined tanks are pits dug in the ground with a ferro-cement plaster lining. These designs were developed with emphasis on effectiveness and low cost. The size of tanks used for MUS systems is based on the flow rate of the spring and the planned need of the projected future population of the village or cluster.

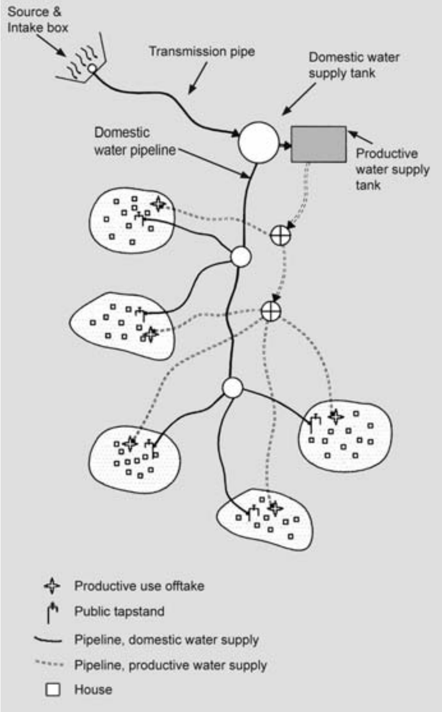
The water is then distributed to two different types of outlet delivery structures—"hybrid tapstands" and "offtakes." Hybrid tapstands have two different types of taps on them: one is a domestic tap under which a jug or other water-storage container can rest as it fills, and the other is an irrigation tap designed to directly attach a hose to fill up the drip irrigation header tank or operate a sprinkler. Offtakes are single-use taps that are low to the ground and designed with two taps to attach hoses for filling the drip irrigation header tanks or attach directly to the sprinkle system.

**Figure 2.2a Single-tank, one-line distribution system**




Courtesy of Deepak Adhikari.

**Figure 2.2b Double-tank, two-line distribution system**




Courtesy of Deepak Adhikari.

The use of these two types of outlets is based on both the type of system (single-tank, one-line distribution or double-tank, two-line distribution—see Figures 2.2a and b) and the location of the bari land that the households will be farming. In single-tank, one-line distribution systems, if the bari land is isolated from the house, then an offtake will be located in the bari area for those households to use for irrigation, and a hybrid tapstand will be located near the homes for domestic purpose. If the bari land is near the homes, then hybrid taps will be built for those households to use for both domestic and irrigation purposes. On the other hand, with a double-tank, two-line distribution system, in order to keep the use of domestic water separate from the use of irrigation water (to ensure sufficient quantity of domestic water even in the dry season in water-scarce areas) hybrid tapstands are designated for domestic use and located near the homes while offtakes are designated for irrigation use and are located near the bari land. All tanks, hybrid tapstands, and offtakes are constructed on-site by a trained mason (someone either hired from outside the village or trained as a mason in the village by SIMI staff) with labor contribution from all households in the community. As the first single-tank, one-line distribution system, the Chhatiwan case study in chapter 3 gives more background on the genesis and uses of this system. The Senapuk case study in chapter 4 shows the development of the first double-tank, two-line distribution system.

The hose that connects to the offtake or irrigation tap on the hybrid tapstand to fill up their microirrigation header tanks is not included in the cost estimation or design of the MUS system unless there is a special request from the community to do so. If the cost estimation is included in the system design, the community can choose to seek outside funds to cover that portion of the design, or they can contribute it themselves. Otherwise, the cost of the hoses is borne by each household, based on the length of hose needed to reach its field from the hybrid tapstand or offtake.

In order to enable equal distribution to each hybrid tapstand and offtake on uneven terrain, equal flow must be distributed to each outlet on a timed basis. To ensure that equal delivery time actually supplies equal volume, pressure regulators are used to adjust the discharge rate at each outlet. These pressure regulators are commonly used in domestic water systems in the hills where there are large elevation differences between taps.

## MATCHING FUNDS

A concurrent process to creating the system design is the search for matching funds from project partners. Before a project can actually be fully approved, communities are required to secure the necessary funds. First, the SIMI district team determines a basic budget projection including how much is required from other partners. This budget is described to the community, and discussion is held to assist the community in identifying potential funding partners. The community (with Social Mobilizer/Community Mobilizer assistance) goes to local organizations—clubs, other NGOs, GOs,[4] local government,[5] etc.—to seek funding. The SIMI team concurrently seeks funding from district- and national-level GOs and NGOs. Once verbal interest is received from various partners, a detailed cost analysis is completed as part of the engineering survey. The actual financial requests of these potential partners are then made. The success rate of actually acquiring funds is greatest at the community level, then the district level, and finally the central level. Once the required budget is secured through various project partners, the implementation is finalized. Only after this does the central-level SIMI staff send the full documents to all project partners and the district office for signature.

## MICROIRRIGATION

The other major technical components of the Nepal MUS systems are the microirrigation kits that the farmers are encouraged to purchase for efficient irrigation of their high-value crops. Farmers are offered a variety of microirrigation kit choices as shown in Table 2.1. Appendices 1 and 2 explain the specifications of the drip and sprinkle systems. Irrigation kits can be expanded for an additional cost, giving the farmers the potential to increase their irrigated area over time with their production earnings.

**Table 2.1: Available microirrigation kits**

| Irrigation Type | Kit Size | Area Irrigated ($m^2$) | $ Cost |
|---|---|---|---|
| Drip | Very small | 80 | 13.60 |
| Drip | Small | 125 | 17.50 |
| Drip | Medium | 250 | 28.70 |
| Drip | Large | 500 | 54.90 |
| Drip | Very large | 1,000 | 106.20 |
| Sprinkle | Medium | 250 | 11.30 |
| Sprinkle | Large | 500 | 21.30 |

Source: SIMI data.

There are a host of benefits farmers receive through use of microirrigation. Due to a 50 percent water savings compared to flood or furrow irrigation, the use of drip or sprinkler systems enables the irrigation of a larger area. The frequent application of small amounts of water also limits deep infiltration losses and reduces the chance of water stress on plants, resulting in increased production. Additionally, it improves the quality of the produce because it reduces the incidence of disease and damage. Farmers can reduce their labor costs by reducing irrigation and weeding time. Since drip irrigation applies water near the plant and minimizes water application away from the plant, weed growth is retarded in the area away from the plants. And, less fertilizer is required due to accurate fertilizer application through the drip system. The major problem with microirrigation is blockage of the emitters due to use of water with high particulate matter. Since most of the MUS projects developed spring sources for use with the microirrigation kits, and the particulate matter in spring water is low, this problem is mitigated. A more in-depth discussion of the technologies used in the Nepal MUS systems, the reasoning by which they were chosen, and the implications of their use can be found in Yoder et al., 2008.

## ON/OFF-SEASON PRODUCTION

The major goal of incorporating microirrigation into the MUS systems in Nepal was the ability of farmers to grow high-value vegetable crops both on- and off-season. The designation of on- and off-season varies according to the vegetable produced. The on-season is the traditional season when a vegetable is grown in Nepal. For example, cucumbers are normally cultivated during the monsoon season (mid-June to August). Farmers receive a lower price when they sell cucumbers in this season because there is a glut in the market at this time. However, if farmers can grow and sell cucumbers in the premonsoon season, there is less supply in the market, and they can receive up to 100 percent higher prices in this off-season.

Cultivating vegetables in the off-season does require sufficient irrigation water, greater financial outlay, and technical knowledge. If farmers can access the requisite funds at the beginning of the season, the returns are high enough to cover the initial financial burden and provide a higher profit. As part of the MUS projects in Nepal, SIMI helps farmers access water for productive use, microirrigation equipment for efficient application of the water, technical knowledge to grow the crops, and assistance in marketing. The Water User Committees set up in villages through MUS projects also establish a loan fund to help those who need assistance at the onset of vegetable production. The four vegetables cultivated by MUS farmers that receive the highest off-season return are cucumber, capsicum, bitter gourd, and tomato.

## TRAINING

A key component in the success of the Nepal MUS projects is the training that SIMI provides. Training helps to increase knowledge, disseminate technologies, build capacity, increase market acceptability of produce, and raise awareness of different ways to increase farm income.

Before training sessions are conducted, skills within the community are assessed. If there is a mason or plumber available within the community, he will be ultimately responsible for heading up the construction tasks. However, for any construction he is unfamiliar with, SIMI provides a trainer to help during the construction process. This builds the knowledge of the mason or plumber as well as the rest of the community. If there is no plumber or mason within the community, one from outside the community is hired with oversight from the construction committee and SIMI team.

Training sessions conducted for every MUS project and their timing include:

- Plumbing/Masonry—after the detailed design and estimate are completed, but before construction begins
- Scheme Management training
  - ~ Assembly—during construction phase as on-the-job training
  - ~ Repair and maintenance—just after completion of MUS and refresher training when problems are encountered
  - ~ Users orientation training about operation of the scheme—Just before completion of MUS construction
- Water resource training—just before the completion of system construction
  - ~ Safeguarding of water tanks, management of water, and water distribution. Among other topics, these trainings included information on water purification (filtration, boiling, etc.), cleaning of drinking water containers, and the importance of using each type of tap for its designed purpose (tapstands for domestic and offtakes for irrigation) to ensure sufficient domestic supply.
- Farmer-to-farmer training tour program to other vegetable production area to see existing schemes—just before or just after the completion of system construction
- Microirrigation technology
  - ~ Pre-use training—just before drip installation and crop transplanting time
  - ~ Post-use training—sometime during the crop season, just before harvesting, or just before the drip system is stored
  - ~ Repair and maintenance—during cultivation once the drip lines are installed for use
  - ~ Agriculture production techniques—just before the specific season for each crop; postharvest training is conducted just before the harvesting of crops; the other trainings are less time-sensitive and depend on the situation
  - ~ Off-season vegetable production, nursery preparation and management, Integrated Pest Management (IPM), Integrated Plant Nutrient System (IPNS),[6] soil solarization, compost making, post-harvesting practices, plastic tunnel development, seasonal-crop planning, plastic-house construction, crop-sowing methods and timing, and crop health
- Income-generation techniques
- Trainings specifically for women—at the same time as the agriculture-production technique training
- Production cycles, postharvest handling, agroprocessing techniques, developing sustainable rural institutions

In order to select the trainees for each session, the WUC calls a meeting and selects the trainees depending on who has time and who is able to share what they learn with those who are unable to attend. Many of the trainings are conducted by SIMI staff, but some are done by other local organizations or line agency staff. Key people in the village are also trained by SIMI staff to become trainers themselves. These individuals are then responsible for conducting some of the later trainings. Most of the trainings are practical in nature and include field demonstrations and exposure visits.

Training programs lasted anywhere from two hours to seven days, depending on the subject matter. More intensive training periods were held at the beginning of the project, and the time involvement tapered as the project progressed.

## MARKETING

In order for farmers to see the highest returns on their investment in microirrigation technologies and the productive component of the MUS systems constructed, they must be connected to markets. Since most MUS farmers have not sold vegetables as cash crops before, a marketing component is a major part of the MUS project. As part of the wider SIMI project, production groups have been established in many villages. SIMI starts marketing groups based around key regional markets by linking production groups in multiple VDCs. These marketing groups share the same collection center for sale of vegetables and elect a collection committee to run the operation. The committee is responsible for collecting and weighing the vegetables and taking them to the nearby market for sale. A fee (usually NPR 1/kg of produce) is collected by the committee to cover the cost of operating the collection center and transportation to the market.

There are now 70 marketing committees and 60 collection centers, 15 of which have become cooperatives. Two districts have also created apex marketing committees that represent the committees in their district and help them market outside of the district.

## COSTS OF MUS PROJECTS

Due to different designs and village/cluster sizes, distance from the source, and other factors, the cost of each MUS system varies. However, when looking at the whole range of MUS projects in Nepal, the average project cost per household of a MUS system is shown in Table 2.2. This cost estimate spans the project implementation period of 2003–2008 and includes the cost of agricultural interventions.[7]

**Table 2.2: Average system project cost 2003–2008**

| Average direct MUS costs | NPR | $ |
|---|---|---|
| System | | |
| Cash costs | 142,500 | 2,262 |
| Noncash costs | 95,500 | 1,516 |
| **Total** | **238,000** | **3,778** |
| Average staff costs | 30,000 | 476 |
| Staff fringe (50 percent) | 15,000 | 238 |
| Overhead, other indirect (21 percent) | 3,000 | 48 |
| **Total direct/indirect costs per MUS** | **286,000** | **4,540** |
| Average households per MUS system = 36 | | |
| MUS cost per household | 7,944 | 126 |
| Average cost per household for agricultural interventions | 4,400–6,300 | 70–100 |
| **Overall cost per household of MUS (including agricultural interventions)** | **12,344–14,244** | **196–226** |

Source: IDE MUS project data.

CHAPTER 3

# CHHATIWAN: ABUNDANT WATER

Photograph by Monique Mikhail.

Chhatiwan Tole cluster of the Chirtungdhara VDC in Palpa District was chosen as a case study to represent a community with an abundant water supply. It was the very first MUS system constructed. The background information for this case study came from an earlier review of MUS called Nepal Process and Impact Study of the Multiple Use (Hybrid) Gravity Water Supply Schemes in Palpa and Syangja Districts of West Nepal conducted by Eco-Tech Consult Ltd. in October 2004. A visit to Chhatiwan in October 2006 was conducted by IDE international staff and a consultant from the Monitoring and Evaluation Section of the Department of Agriculture. It included a group interview of five out of the ten households and then individual household interviews of the same five households in the presence of the whole group. Another visit in March 2007 of both international IDE staff and national SIMI staff included an interview with six of the ten households, an interview with Dal Bahadur Disa, and interviews with local SIMI staff.

## SITUATION ANALYSIS

### COMMUNITY SETTING

As discussed in chapter 2, the Chhatiwan MUS system was the first constructed and was a single-tank, one-line system. A similar system solely for microirrigation was built in the neighboring village of Gaptung and the results of the two systems were compared.

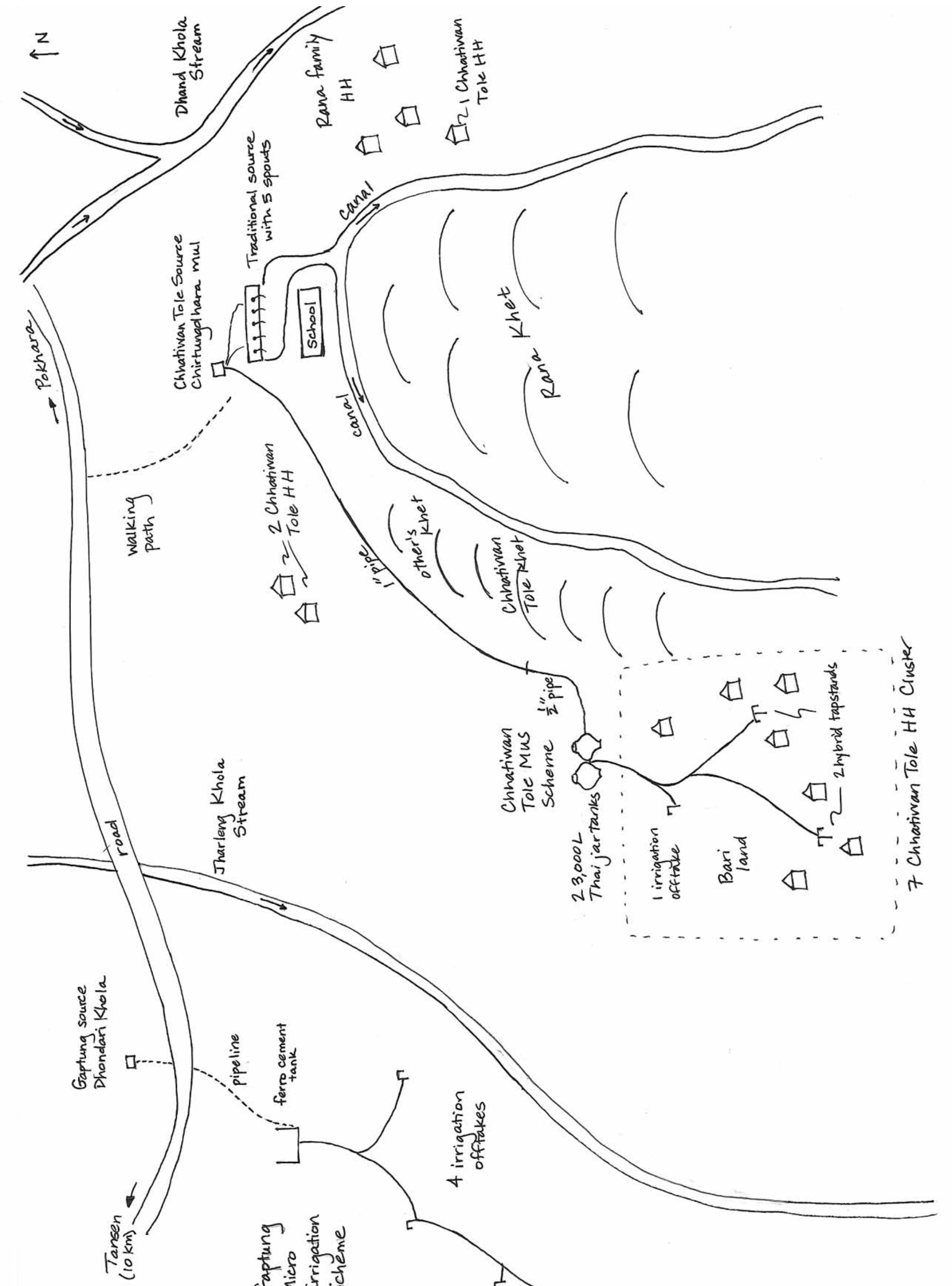
#### Location and Climate

Chirtungdhara VDC is in the middle hills of Nepal. The Chhatiwan Tole group lives within the Chirtungdhara VDC about a one-hour walk southeast of Tansen municipality at an elevation of just under 1,000 m (see Plates 1 and 2). Chhatiwan Tole members can reach Siddharth highway connecting the Indian border to Pokhara with a 20-minute uphill walk and then access the nearest market in Tansen by traveling ten km on an all-weather road (see Figure 3.1). The area receives an annual rainfall of about 1800 mm. Rainfall distribution, temperature range, and evapotranspiration rates are shown in Table 1.2 in chapter 1.

#### Population Demographics

Chirtungdhara is a Magar community of Tibeto/Burmese ethnicity that migrated to Palpa from Eastern Nepal over seven generations ago. The Magar ethnic group has historically been heavily employed in the military—Indian, British, and Nepali—so many households have pensions. The resident population of the nine wards of Chirtungdhara VDC is just under 900 households, and the average family size in Palpa District is five or six members.

**Figure 3.1 Schematic of Chhatiwan Tole and Gaptung**




Courtesy of Monique Mikhail.

The Chhatiwan Tole cluster consists of ten households in the fifth ward of Chirtungdhara VDC. Seven households live in the same cluster, while three additional households only have their bari land near that cluster, but their homes are located elsewhere. The average family size of the Chhatiwan Tole group is nearly eight members; however, due to family members living and working abroad, there were only 40 residents during the project construction. Just over 80 percent of the household members who are between school age and fifty are literate, nearly double the Nepal country average.

## Socioeconomic and Food-Security Situation[1]

As a result of the close proximity to the district headquarters of Tansen, there is opportunity for day-labor work for Chhatiwan members. However, during the time of the field survey none of the households utilized this option, probably due to lack of ease in transport. Thus, agriculture remains the only economic activity in the community. Nonetheless, every household has a member either receiving a pension from the Indian Army (eight households) or having employment in India (three members) or the Middle East (six members).

Because of the pensions and remittances, Chhatiwan Tole is a reasonably wealthy community compared to other communities in the middle hills. Each household has a toilet, and most have biogas plants that provide much of their cooking energy. They do have electricity but no telephone system. Most households have a television, and all have radios, which aid in information flow.

Owing largely to their external income, only one of the five households interviewed reported a deficit budget for the previous year, which had been caused by serious illness of a family member. One has a food deficit for one to two months in most years. That household is now using income from vegetable sales to purchase cereal.

The average landholding in the community is about 1.5 ha with almost equal size bari and khet (see Table 3.1). Some of the bari and khet is nearby the cluster, while some of it is further away. From greatest to least in size, the designations are nearby bari, nearby khet (only three households), far-away khet, and far-away bari. Landholding size has actually increased over the past few decades because Chhatiwan Tole farmers have invested their income in the purchase of khet land within the VDC but outside of the Chhatiwan Tole area from farmers who are migrating out of the area. Because family sizes in Chhatiwan are increasing, they feel that they need more khet land in order to be self sufficient in grain. Three of the cluster households rent land from the Rana family on a 50/50 sharing basis, which means that they give 50 percent of the production as rent. Some households also reported investing in gold jewelry as another way to secure their wealth.

**Table 3.1: Landholding sizes of surveyed households in Chhatiwan Tole**

| Land Type | Ownership | Sampled Household Landholding (ha) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | # 1 | # 2 | # 3 | # 4 | # 5 | Total | Average |
| **Khet** | Owned | 0.74 | 1.48 | 0.54 | 0.46 | 0.27 | 3.48 | 0.70 |
| | Leased | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.08 |
| **Bari** | Owned | 0.34 | 0.27 | 0.20 | 0.40 | 2.00 | 3.21 | 0.64 |
| | Leased | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.27 | 0.05 |
| **Kharibari** | Owned | 0.17 | 0.00 | 0.00 | 0.08 | 0.00 | 0.24 | 0.05 |
| **Total** | | 1.91 | 1.75 | 0.74 | 0.94 | 2.27 | 7.60 | 1.52 |

Source: Household interviews with five out of the ten households — October 2006.

### Pre-project Agriculture

In addition to field crops grown according to the cropping patterns described in chapter 1, all households in Chhatiwan Tole have some fruit trees: guava, citrus, papaya, mango, apricot, pear, and jackfruit. Some households have annual sales of mango and jackfruit of up to NPR 600 ($8.60). Most farmers have similar soil types and use fertilizer, pesticides, manure, and compost as inputs for their crops. Purchase of improved and hybrid seeds, pesticides, and chemical fertilizers has also increased in recent years.

Livestock provide meat, milk, and manure, with poultry and goats comprising the two largest animal-production activities in the village. On average, households have four oxen, three cows, five goats, one pig, and six chickens.

## INITIATION OF THE MUS SCHEME IN CHHATIWAN

In 1998 IDE, in partnership with an INGO called Helvetas, carried out a program in Palpa District for expanding the use of microirrigation for market crops. They met with the Palpa Feeder Grass Development Group, an association of smaller groups from each VDC in Palpa. They set up ten demonstration plots and held a farmer-visiting tour to demonstrate and market the use of microirrigation equipment. When farmers purchased the microirrigation kits, IDE also provided extension services for vegetable-crop production and marketing. Unfortunately, many farmers in Palpa only had their domestic water supply as an irrigation water source, so they were under-irrigating their crops. Subsequently, IDE began receiving requests from villagers to help them plan and develop their limited water resources for more effective utilization.

As part of the joint IDE-Helvetas project, a farmer named Dal Bahadur Disa in a village named Gaptung was chosen to be trained as a leader farmer. He was given 51 days of training and then in turn became a trainer for other farmers, which included assisting in the microirrigation demonstrations and farmer-visiting tours mentioned above. Not only did he provide training to assist in uptake of microirrigation technologies and vegetable production, but he helped communities to establish local vegetable production groups. Most important, he provided a link for other communities in disseminating important information about IDE's work in developing small water resources like springs for vegetable production.

Dal Bahadur's first lobbying effort for source development was for his own village of Gaptung. The community already had an adequate domestic water source but was limited in its production due to a lack of adequate irrigation water supply. Dal Bahadur arranged for IDE technical staff to meet with his community to discuss construction of a storage tank and pipe system to supply them with additional irrigation water. As IDE began working with the Gaptung community to develop a nearby spring for irrigation, Dal Bahadur continued his trainings,[2] and shared information about IDE's work in Gaptung with the nearby Chhatiwan Tole cluster of Chirtungdhara village. The ten households of Chhatiwan Tole had previously organized themselves with the help of Dal Bahadur into the Chhatiwan Tole Vegetable Production Group, and two of the households had purchased microirrigation kits as a result of the earlier demonstration project. This had positioned them as a well-organized community ready to lobby on their own behalf. And while they had access to a very large spring for all their water needs, they found it difficult to carry all of the necessary water for both their domestic needs and the drip irrigation systems they had recently purchased. They realized that if IDE could help them develop their water source like Gaptung's, they would have easier access to water for all their needs.

As a result of the interest shown by the Chhatiwan Tole farmers and encouragement from the Chirtungdhara VDC officials, the SIMI project staff visited Chhatiwan Tole and held a meeting with all stakeholders. Discussion quickly centered on the community's interest in upgrading the domestic water supply system so that they could more effectively apply the excess water for vegetable production on their bari land (the overflow from the domestic system already supplied gravity-fed canals to some of their khet land as described in detail below). At this meeting SIMI staff clarified conditions necessary for partnering on the project (the same as those listed in the "Project Implementation" section of chapter 2), which included a requirement for written confirmation that they had permission to use the source of water for both domestic and irrigation purposes. The Chhatiwan Tole farmers were able to show that they had permission to use a portion of the water through a prior agreement made between a previous Chhatiwan leader and Mr. Kul Bahadur Rana, the registered owner of the Chirtungdhara *mul*[3] water source (explained in detail below). The agreement included assurance that the Chhatiwan Tole farmers would not interrupt the water supply during rainy-season paddy cultivation.

## WATER ACCESS PRIOR TO PROJECT IMPLEMENTATION

The source used for the MUS scheme is the large perennial Chirtungdhara mul spring which emerges in a gully that is dry except during the rainy season. The Chirtungdhara mul has been used for domestic and irrigation purposes for decades. It was protected in 1989 by the local VDC with a covered masonry structure, and five water spouts were installed to provide easy access for the community. Water flows continuously from these spouts (see Plate 3). Although the spring is licensed to the descendents of Mr. Rana, several nearby communities (totaling about 50 households) come to this source to collect water for their domestic needs. These communities have arranged use of the spring water by ensuring sufficient water allocation to the Rana family for their paddy cultivation. Prior to MUS construction, Chhatiwan Tole farmers had to walk 15 minutes each way to collect water from the spring.

When Mr. Rana registered the source with the VDC decades back, he constructed several hectares of terraced paddy fields and developed two small gravity canals that follow the contour away from the stream on the right and left banks, flanking his khet land on each side (see Figure 3.1). The excess water from the five spouts flows into the canals. Previous Chhatiwan Tole members had signed a written agreement with Mr. Rana in the presence of the VDC Chairman at the time to use some of this water for both domestic purpose and paddy cultivation. One member, Mr. Jue Dhar Disa, extended a part of the western canal to deliver water to the khet owned by Chhatiwan Tole members. As per the agreement, water only flows down one branch of the canal at a time and is blocked from the other branch. The canal water runs for seven to ten days on one side and then is diverted to the other side for use. This system is still in place, and the Chhatiwan Tole farmers use it solely for the nearby khet they own and rent from the Rana family. Mr. Rana is now deceased and his land has been divided among four family members who retain the right to the spring. However, canal management is run by a water user association for the whole canal area. Khet land that Chhatiwan Tole farmers own outside of this canal area is irrigated by other canal systems.

In 2002, after the Chhatiwan Tole Vegetable Production Group was established and microirrigation kits were being used by some of the farmers, but prior to the initiation of the MUS project, the community lobbied the local VDC council to provide them with a half-inch pipe to deliver water directly from the source to their community for domestic use. This system was only in use for two months before conversations with IDE led to the construction of the MUS system in 2003. The half-inch pipe was later used as part of the MUS system.

## PROJECT PLANNING AND IMPLEMENTATION

### CONSTRUCTION COMMITTEE/WATER USER COMMITTEE

Chhatiwan Tole farmers had previously been—and continue to be—participants in the Chirtungdhara Feeder Grass Development Group in the VDC, which was established in 1994 as one component committee of the larger Palpa Feeder Grass Development Group in the district. As mentioned above, in 2000 the Chhatiwan Tole farmers formed their own Chhatiwan Tole Vegetable Production Group with the help of Dal Bahadur Disa. They had monthly meetings to discuss problems with seeds and marketing and collected NPR 5/month/household as a revolving fund for the group.

In 2003 when conversations began with SIMI for MUS construction, the Chhatiwan Tole Vegetable Production Group transitioned into the Chhatiwan Tole Construction Committee. Like the vegetable group, the 11-member Construction Committee had two female and nine male representatives led by a chairperson, secretary, and treasurer. The committee, along with SIMI staff, created an action plan for system design and construction. Once the scheme was constructed, the committee again transitioned into the Chhatiwan Tole Water User Committee (WUC), maintaining the same structure and committee composition.

### SYSTEM DESIGN

#### Water Resource Assessment

Upon investigation of the water resource situation, SIMI's Palpa District team concluded they could work with the Chhatiwan Tole farmers to improve the existing water supply system to make it more useful for microirrigation and at the same time more accessible for the cluster's domestic needs. The source has good quality water with a large flow volume and is located reasonably close to the community. And the fact that the Chhatiwan Tole farmers already had a written agreement allowing them to use a portion of the Chirtungdhara mul water for domestic and productive needs was an important factor. However, even with the previous agreement for access to the spring, the other surrounding communities using the Chirtungdhara mul were hesitant to allow Chhatiwan Tole to directly attach a pipe at the spring. Chhatiwan farmers negotiated with the surrounding communities to allow them to build the scheme, agreeing to take just a small portion of the flow and then direct overflow water from the MUS scheme tanks back to the public system.

In September 2006 it was estimated that 0.3 liters per second was being supplied to the Chhatiwan Tole community on a continuous (24/7) basis. The combined discharge from the five spouts, not including the water piped to Chhatiwan Tole, was measured in September 2007 as 1.7 liters per second. September is the end of the rainy season when the spring is at its peak discharge, so these flow rates indicate the high-flow season. However, all Chhatiwan Tole community members interviewed stated that the spring has only a slight reduction in discharge during the dry season. Thus, the Chirtungdhara mul is providing Chhatiwan Tole with an abundant quantity of water throughout the year.

## Projected Water Needs

Once the source was deemed appropriate and negotiations for the right to use a portion of the water were concluded, a detailed engineering survey was conducted to determine the most effective design for the system. The 40 residents in the ten families of Chhatiwan Tole at the time of project design were projected to increase to 45 within the design period of ten years. A design standard of 45 liters/capita/day was used to estimate the domestic water demand of 2,025 liters per day. Since the water supply is abundant, an additional 700 liters/household/day were allocated to all ten households for productive needs, resulting in an additional 7,000 liters per day demand. The design requirement totaled just over 9,000 liters per day. It was concluded that 6,000 liters of storage was adequate since the water from the spring is available continuously even in the dry season. Given that Chhatiwan was the first MUS scheme constructed, IDE was still in the development phase of several new water storage containers, and the largest completed design had a 3,000-liter capacity. Hence, the system design included two of these containers.

**Figure 3.2 Positioning of intake in relation to traditional structure.** Photograph by Monique Mikhail.

## SYSTEM CONSTRUCTION

Once the need was determined and the design established, the MUS system in Chhatiwan Tole was constructed in just 17 days. Each household contributed one person to provide labor, and a mason from outside the community was hired to build all of the masonry structures; women contributed 60 percent of the total labor requirement. The system intake, located just above the traditional spouts (see Figure 3.2), consists of a masonry connecting box (see Figure 3.3) at the spring with a shutoff valve that connects to a 32 mm HDPE transmission pipe. The 500 m long transmission pipe is buried for protection and terminates at two Thai Jar storage tanks, each holding 3,000 liters (see Figure 3.4).

**Figure 3.3 System intake**

Photograph by Monique Mikhail.

**Figure 3.4 Two 3,000 liter Thai jar storage tanks**

Photograph by Robert Yoder.

## SYSTEM OPERATION

The outlet from the storage tanks is controlled by a valve that connects to the single distribution line leading to two hybrid tapstands (see Figure 3.5a/Plate 4). These hybrid tapstands provide domestic water for the seven households with houses located in the cluster, one stand for four nearby households, and the other for three households. They take turns using these taps to fill up their individual 200-liter drums that were purchased independently prior to the MUS project for domestic purposes. The hybrid tapstands also provide the water for productive use, with the households' rotating filling their drip system header tanks. As part of the MUS project, each household purchased a 20 m long flexible PVC hose to deliver water from their hybrid tapstand or offtake to their microirrigation system header tank. One additional irrigation-only offtake (hose connection) is located near the fields further from the house cluster (see Figure 3.5b/Plate 5). This offtake provides water solely for irrigation of bari land to the three households with homes located too far away to collect domestic water at the Chhatiwan Tole tapstands. For domestic water they have another domestic system closer to them. For productive water, these three households take turns connecting their hoses to the offtake to water their crops as needed (see Plate 6).

System operation was originally planned to deliver water for four and a half hours in the morning with distribution at the Thai Jars shut off to let them refill for six hours followed by another four and a half hours of distribution in the evening. However, since the supply from the spring is continuously delivering water at a rate of about 0.3 lps (26,000 liters per day), the two 3,000-liter storage tanks are never empty. With such an abundant water supply for ten households, they do not need to closely regulate the water distribution from the storage tanks and in practice the valve from the storage tank to the distribution line is kept continuously open. Any farmer has access at all times to use water according to their need. They simply turn the tap on at the hybrid tapstand or offtake and then turn it off when finished filling their 200-liter household storage containers or irrigation header tanks. Because Chhatiwan Tole is a water rich community and there is more than enough water on demand at all times, there is little need for a robust management committee, so the WUC never appointed someone to oversee system operation. Their major remaining function is maintenance of the system when problems occur. However, since the members of the WUC are the same as the original Chhatiwan Tole Vegetable Production Group, they still meet to share information about vegetable production.

Each of the ten households also purchased and installed a 125 $m^2$ drip kit for applying water to their vegetable gardens, and one household purchased a sprinkle set in addition to the drip kit. Purchase of the microirrigation kits was not considered in the MUS project costs, but a separate purchase at full cost by the households. Even with such an abundant water supply, Chhatiwan

**Figure 3.5a Chhatiwan WUC member standing by hybrid tapstand**

Photograph by Monique Mikhail.

**Figure 3.5b Farmer kneeling beside irrigation offtake**

Photograph by Bimala Colavito.

farmers recognized the significant advantages of using drip irrigation—reduced labor costs, weed growth, and required fertilizer as well as increased production and quality. (The explanation of the benefits of microirrigation can be found in the "System Components" section of chapter 2.)

Two households have since added additional drip kits and several others mentioned plans to expand their drip systems. However, despite the benefits of microirrigation, all households already grow vegetables on a larger area by applying water directly to the plants from the connecting hose or by bucket. Allowing 500 liters for domestic use by seven households there is still 2,250 liters/household/day available for productive use by the ten Chhatiwan Tole households. This is enough for vegetable production on about 1,125 $m^2$ area per household. Reviewing table 3.1, the smallest owned bari land area of the surveyed households was 2,000 $m^2$, indicating that the farmers have ample irrigable land available to use all of the productive-use water and will be expanding their production to fit available household labor.

Unfortunately, system care has been somewhat of an issue for a few households. One woman's drip kit was damaged by a mouse that chewed through her lines. Some of the community drip tanks were also slightly damaged by hailstones.

## SYSTEM COST

Contributions for financing the Chhatiwan Tole MUS scheme can be seen in Table 3.2.

**Table 3.2: Financial contributions for Chhatiwan Tole MUS scheme**

| Organization | NPR | $ | Percentage |
|---|---|---|---|
| IDE Nepal | 27,924 | 387 | 36% |
| Helvetas LIPS Project | 27,924 | 387 | 36% |
| Chirtungdhara VDC | 4,000 | 55 | 5% |
| Chhatiwan Tole Construction (Labor and local materials equivalent amount. Microirrigation kits not included) | 17,433 | 242 | 23% |
| Total | 77,281 | 1,071 | 100% |

Source: SIMI detailed survey report.

The microirrigation kits were not part of the MUS scheme financing but were purchased by individual households at full cost. So in addition to the above costs, the farmers were responsible for purchasing their own microirrigation technology at a cost of around NPR 1,025 ($14) per household from their own savings. They also decided to purchase their own hoses to connect to the offtake and fill their header tanks for their irrigation kits. Depending on the length of the hose, it cost NPR 400–NPR 1,800 ($6–$26). An NPR 3,500 ($49.00) fund remains from the amount collected for construction. This acts as a revolving loan fund, with the interest being used for repair and maintenance.

## CAPACITY BUILDING

Although the residents of Chhatiwan Tole had grown a few vegetable plants each year in the past, it was an ad hoc endeavor for household consumption with little labor input and no use of other inputs. Since production of high-value crops for sale was a much different undertaking, the skill set of the farmers needed broadening to ensure the greatest outcome possible from the productive portion of the MUS project. As mentioned above, SIMI staff led many training sessions as part of the MUS project: nursery raising; transplantation; crop-sowing methods, timing, and health; pesticide and fertilizer management; harvesting and post-harvesting; microirrigation system operation; pipe assembly and maintenance; MUS system management (including safeguarding of water tanks); and repair and maintenance. Trainings specifically for women focused on production cycles, postharvest handling, agro-processing techniques, and developing sustainable rural institutions.

## MARKETING

Just like assistance in vegetable production, connection with markets is one of the pillars of IDE's poverty-alleviation approach. As part of the SIMI project, formation of marketing committees to assist farmers in selling their new high-value crops was a key element of the project. The main market for Chhatiwan Tole is the district headquarters of Tansen, which is nearly ten km away. Tansen is home to the regional army, police, hospital, and government offices. As the regional hub, the demand for fresh vegetables is high.

As part of the SIMI project, in 2003 many newly formed vegetable production groups from the Chirtungdhara VDC and surrounding VDCs started a marketing group to share a collection center for sale of vegetables, electing a collection committee to run the operation, with Dal Bahadur Disa as acting chair. The committee was responsible for collecting and weighing the vegetables and taking them to the Tansen market for sale (see Plate 7). To cover the cost of operating the collection center and transportation to Tansen, NPR 1 per kg was collected from each farmer. The vegetable collection center was about a 45-minute walk up the hill from the settlement.

Not long after the initiation of the marketing center, they started having problems. The farmers wanted payment upon deposit of their vegetables, while the collectors could not pay them until after they sold the vegetables. The committee members would take the vegetables to the wholesale market where the wholesalers would weigh the vegetables and the traders were supposed to purchase their products. Since the traders all tried to bargain down the prices, it took a great deal of time and effort for the committee members to determine which trader would give them the highest price. The prices for vegetables also fluctuated dramatically from day to day. The committee members would promise the farmers a price based on the previous day's prices, but often the current day's price would fall well below that, causing conflict with the farmers who wanted to receive the amount they had been promised. Committee members had to pay the remainder out of the marketing committee funds, which rapidly depleted them. The farmers did not fully realize that the prices were fluctuating so dramatically and felt that the committee was keeping a sales margin for themselves. Eventually the committee went bankrupt and lost the support of the community, so the collection center was disbanded in 2006.

Sometimes one farmer still collects the vegetables and sells them for the community, depending on the types of vegetables produced at that time and the volume of production. However, this is only on an ad hoc basis, and most of the time farmers take the vegetables individually to the Tansen market. Many of them sell their vegetables along the way and are completely sold out by the time they reach the market.

## OUTCOMES

### VEGETABLE CULTIVATION AND INCREASED INCOME

With project implementation, all ten households are now growing vegetables both on- and off-season with cultivation being done by both men and women. In one household the woman is running the farming operation. While men tend to be in charge, women have a lot of input in decision making for the household, including vegetable production. And other than plowing, it is women who are responsible for most of the work with vegetable cultivation.

Farmers have started using hybrid seeds for tomato, cauliflower, cabbage, cucumber, and bitter gourd and improved varieties for beans and radish. They continue to use local varieties for leafy greens. The improved yield of these seed varieties led one farmer to adopt a hybrid variety for her maize cultivation. She was pleased with the results and was saving some seed for next year's crop. This shows that education has improved the situation in Chhatiwan but is still not complete. There needs to be more education about what hybrid seeds actually are and their possibilities.

The good quality vegetables are taken to market, but the rest are consumed by the household. It was estimated that about one third of the vegetables grown were consumed or given away to family and neighbors free of charge. The remaining produce was sold as shown in Table 3.3.

**Table 3.3: Average value of vegetable sales in the cluster using MUS (two crop seasons)**

| Vegetable grown | Average Production per Household (kg) | Sales Price(NPR/kg) | Average Gross Income per Household from Sales (NPR) | Average Gross Income per Household from Sales ($) |
|---|---|---|---|---|
| Radish | 350 | 13 | 4,550 | 65.00 |
| Cauliflower | 190 | 23 | 4,370 | 62.43 |
| Pole bean | 150 | 29 | 4,350 | 62.14 |
| Cabbage | 130 | 7.5 | 975 | 13.93 |
| Tomato | 110 | 20 | 2,200 | 31.43 |
| Cucumber | 110 | 25 | 2,750 | 39.29 |
| Bitter guard | 50 | 28 | 1,400 | 20.00 |
| Bean | 50 | 23 | 1,150 | 16.43 |
| Green leafy vegetables | 38 | 35 | 1,344 | 19.20 |
| Average annual gross income per household from vegetable sales | | | 23,089 | 329.84 |

Source: Five of the ten Chhatiwan households were interviewed as a group in October 2006 to get a sense of vegetable sales over the past year (two crop cycles). The production of the five was totaled and used to calculate the average income from sales. There was no opportunity to cross-check to verify their recall responses.

Households were earning on average NPR 2,900 ($40) from vegetable sales—cauliflower, cabbage, cucumber, tomato, and bitter guard prior to MUS. While this is not an insignificant amount, with implementation of the MUS scheme, the area under vegetable cultivation, quantity and variety of vegetables, and income all increased. Income from vegetable sales after one year of project implementation averaged NPR 23,089 ($330) per household, a major increase. However, it is important to note that although this increase is large and the income change is significant, the portion of total household income that vegetable sales represents is relatively small (on average 27 percent), with pensions and remittances making up the lion's share of their net income. It is also important to consider the economic value of the vegetables consumed, which averaged NPR 7,696 ($110) per household.

The post-project average household gross income including vegetables was nearly NPR 109,270 ($1,561), 38 percent of which came from agricultural sales. The minimum household income from agriculture was just over NPR

3,000 ($43) per year and averaged at about NPR 18,000 ($257). See Table 3.4. After project implementation, annual household expenditures were NPR 30,000–NPR 43,370 ($417–$620). Vegetable sales averaged $73 per household greater income than cereal crops. Profits from vegetable sales are largely spent to purchase salt, cooking oil, and kerosene.

**Table 3.4: Household income and expenditure post-project**

| | Sampled Household Income ($) | | | | | | |
|---|---|---|---|---|---|---|---|
| | # 1 | # 2 | # 3 | # 4 | # 5 | All | Average |
| **Source of Income** | | | | | | | |
| Cereal crops | 47 | 571 | 571 | 53 | 43 | 1,286 | 257 |
| Pensions/ Remittances | 1,543 | 1,200 | 669 | 857 | 600 | 4,869 | 974 |
| **Total Income** | **1,590** | **1,771** | **1,240** | **910** | **643** | **6,154** | **1,231** |
| **Expenditure** | | | | | | | |
| Education | 343 | 0 | 6 | 0 | 179 | 527 | 105 |
| Health | 6 | 0 | 107 | 157 | 643[4] | 913 | 183 |
| Social obligations (marriages, funerals, festivals, etc.) | 71 | 214 | 214 | 129 | 79 | 707 | 141 |
| Agriculture (cereal crops) | 7 | 114 | 171 | 157 | 14 | 464 | 93 |
| Other (clothing, salt,cooking oil, spices, etc.) | 86 | 114 | 65 | 114 | 107 | 486 | 97 |
| Total Expenditure | 513 | 443 | 564 | 557 | 1,021 | 3,098 | 620 |
| Net income/deficit | 1,077 | 1,329 | 676 | 353 | -379 | 3,056 | 611 |
| Net income/ deficit from cereal crops | 40 | 457 | 400 | -104 | 29 | 821 | 164 |

Source: A sample of five households was interviewed in October 2006 to get a sense of annual cash income and expenditures. There was no opportunity to cross-check to verify their recall responses. All of the households grow grain and raise animals for subsistence consumption. Some have excess for sale. It was not possible to quantify the overall agriculture production, consumption, and exchange (sale and barter).

## HEALTH AND NUTRITION

Although food security was not a major issue for this community prior to the project, villagers did say that the major change in their lives from MUS was an overall increase in the quality and quantity of all foods consumed, particularly fresh vegetables. Prior, they bought most of their vegetables, whereas now they consume their own produce. They stated that this gave them an overall feeling of improved health and points to a raised awareness about consumption of a variety of fresh vegetables for enhanced nutrition. At a group meeting, the villagers spoke about the value of vegetables in their diet, saying it was worthwhile to grow vegetables simply for consumption to improve their health, and the extra income was an added benefit.

The MUS system has also increased the quantity of water use for sanitation, bathing, and washing and raised knowledge about the links between hygiene and health. Prior to MUS they carried 75–90 liters/household/day whereas they now have access to 500 liters/household/day. During their interview, one household described the change in hygiene in the community: "Before the water system was built, it was difficult to get the children to wash and keep clean. But now if they go to school dirty, they are ridiculed by friends, which motivates them to wash themselves more regularly."

## TIME SAVINGS

One major change noted by the communities was the time saved in water collection. Before MUS they had to spend 15 minutes walking each way and go to the source five times per day for their daily water needs, adding up to around two and a half hours for water collection daily. Since each household has a 200-liter drum for storage and can access the taps at all times, both men and women collect water whenever the drum needs refilling.

## SKILL BUILDING

A major benefit of participation in the MUS project was the skill building of community members. This was accomplished not only through multiple trainings, but also through planning, construction, maintenance, evolution of the user group, off-season vegetable production, etc. Farmers stated that one of the best outcomes of the project was the increase in their ability to demand new technologies for their village through being organized together. They also now understand the importance of accessing line agency district offices like DADO for production assistance.

## SUSTAINABILITY

Although there is little oversight of system operation, it is perceived that the community will sustain it due to its benefits. With the history of social mobilization in Chhatiwan and the cohesion that the project process has brought, it is likely that they will find a way to work together in the future to ensure continued system success. They indicated that once the current maintenance fund is depleted, they will use a portion of vegetable profits to contribute to future maintenance costs.

However, when speaking with the WUC, they had a few suggestions for potential system improvements. These suggestions are important, particularly considering that this was the first MUS scheme in Nepal and provides important lessons for future systems. They suggested underground storage (perhaps in the same Thai Jar containers, but buried) in order to keep the water cooler and keep children from damaging the tanks. They also felt that one larger tank would perhaps have been cheaper and more useful than the smaller Thai Jars. Since the implementation of this system, IDE has designed larger storage tanks which are now being used in other MUS schemes and are buried. Additionally, since flow is continuous, the community felt that they could have used a smaller pipe to bring the source water to the tanks, which would have been a cheaper alternative. However, if population growth is higher than anticipated, the current pipe could prove useful.

Despite the likelihood of sustained successful system operation, a couple of factors could affect its future sustainability. Although the spring source provides ample water now, if the flow were to diminish in the future, it would require a greater level of water resource management and group collaboration than the current system function. Likewise, if population growth in the area puts far greater constraint on the source than the current situation, it will require much more intercommunity negotiation on the quantity of water allocated per community.

## CONCLUSIONS AND LESSONS

The MUS system provided a host of benefits—increased income, health improvements, social cohesion, time savings in water collection, increased knowledge and awareness of a variety of issues, and increased access to resources. The health impacts of MUS, particularly in increased hygiene and improved nutritional status through vegetable consumption, should not be understated.

The role that the leader farmer, Dal Bahadur Disa, played in both Gaptung and Chhatiwan Tole was crucial. He was essential for information flow between the communities in the district as well as between the communities and organizations like IDE and line agencies. His motivation kept the group moving forward and mobilized them to lobby IDE and local agencies on their own behalf. And the intensive trainings he received allowed Chhatiwan Tole better access to knowledge than the district offices of the line agencies can provide. His role in the MUS process points to the importance of developing these leader farmers and continuing their training so they can build the capacity of other farmers and provide much-needed extension services.

Yet, even with the information transfer through Dal Bahadur Disa and the trainings provided by SIMI, one of the greatest lessons from Chhatiwan is the need for even more education and follow-up with the communities on a variety of issues. In order to prevent problems with microirrigation systems like mice chewing the drip line or hailstone damage that were mentioned above, better storage and maintenance procedures need to be communicated more fully. Additionally, knowledge of the ability to purchase spare parts and where farmers can go to obtain them would be useful.

Furthermore, even though the farmers know that they get much more money from vegetable cultivation, they are opting to purchase khet land and grow rice instead of purchasing extensions to their microirrigation kits to cultivate more vegetables on the bari land they already own with the excess water the MUS system is already providing. This shows the entrenched importance of cereals in the community and the potential for educational activities about financial management at the household level. Financial education would help them logically work through the cost-benefit of growing more vegetables versus more cereals, the sales of which could then be used to purchase cereals with a net profit above what they would make from cereals alone.

Ultimately, no matter how much the community produces, improved marketing is essential. Despite SIMI efforts, there were several reasons the marketing scheme was rejected by Chhatiwan farmers. The collection center was 45 minutes away, as opposed to the market itself, which was one hour away. That slight distance alone does not make the marketing center much more convenient for the farmers, particularly considering that there is a delay in payment if they take the produce to the collection center but immediate payment if they take it to market themselves. When reflecting upon their experience with the marketing committee, the major issue mentioned was access to market information. Due to the results of the marketing committee efforts like those of Chhatiwan, SIMI has strengthened the provision of market information to the communities it works with. Price information is collected from each market center by SIMI, DADO, or AEC staff (depending on the capacity of those agencies in the particular district) and provided to local FM radio to broadcast. Farmers are also encouraged to tune in to the daily Kalimati Wholesale Market Board broadcast from Kathmandu. Moreover, SIMI has also begun creating district apex marketing committees that represent the smaller district committees to government agencies and other organizations and helps them market produce beyond the district.

As the first MUS scheme in Nepal, Chhatiwan proved a learning tool for SIMI staff, influencing their next MUS endeavor in Senapuk and all those proceeding. SIMI staff realized that they could successfully develop a water source for multiple uses, providing greater accessibility to domestic water and multiplying the benefits of microirrigation and marketing efforts.

CHAPTER 4

# SENAPUK: MODERATE WATER

Photograph by Robert Yoder.

The village of Senapuk in Syangja District was chosen as a case study to represent a moderate water supply and the birthplace of the double-tank, two-line distribution system. The background information for this case study came from an earlier review of MUS called Nepal Process and Impact Study of the Multiple Use (Hybrid) Gravity Water Supply Schemes in Palpa and Syangja districts of West Nepal conducted by Eco-Tech Consult Ltd. in October 2004. A visit to Senapuk in September 2005 by international IDE staff and national-level SIMI staff included a physical-system inspection and group interviews. This was followed up by a visit in October 2006 where more formal interviews were conducted by IDE international staff and a consultant from the Monitoring and Evaluation Section of the Department of Agriculture. The local staff, who knew the population well, ranked all households into three categories—poor, middle-income, and wealthy. Two households were selected randomly out of each of the three income brackets for personal interviews. In March 2007 a visit of both international IDE staff and national SIMI staff included an interview with the whole community, a focus-group interview with all women users, a focus-group interview with three of the poorest households, and interviews with local-level SIMI staff.

## SITUATION ANALYSIS

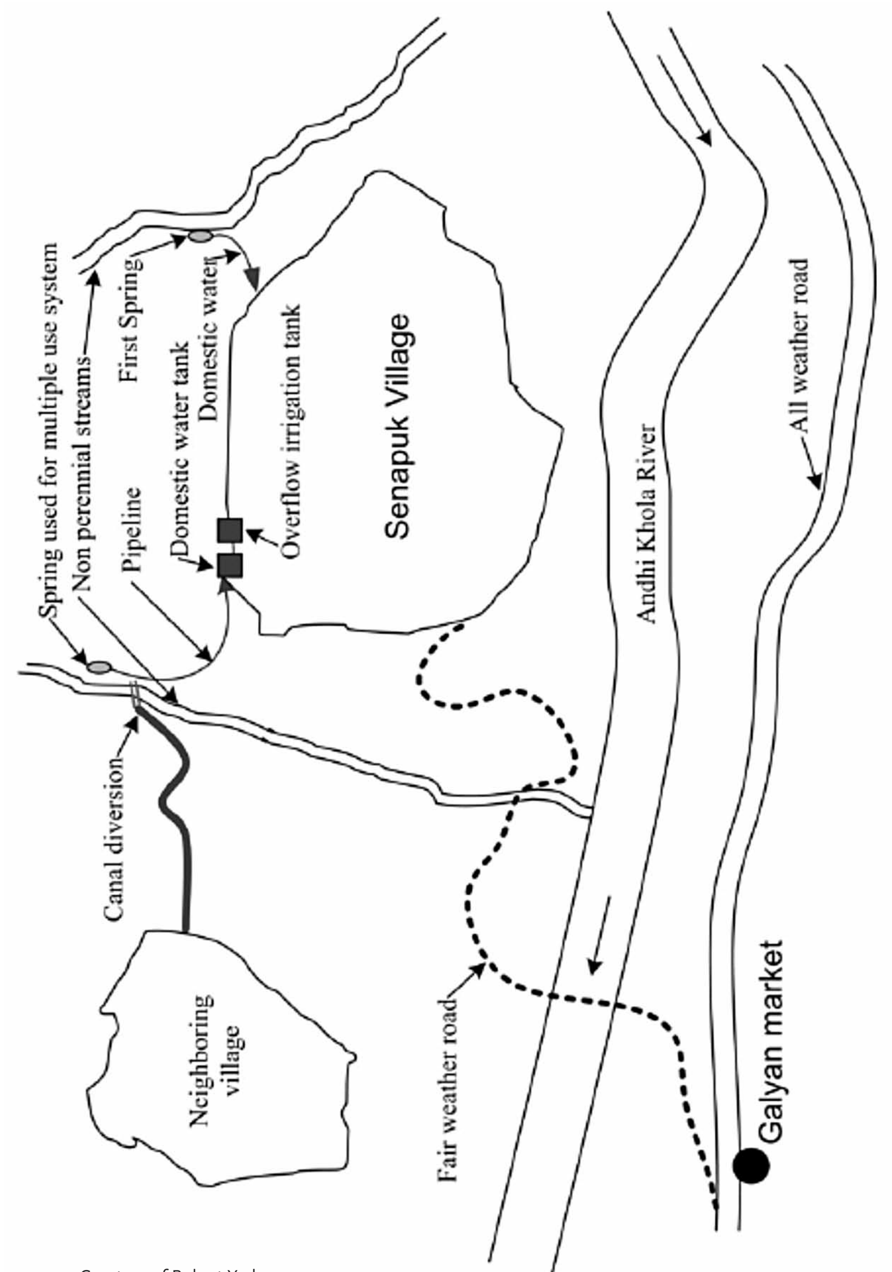
After the single-tank, one-line distribution system in Chhatiwan was completed with successful results (see chapter 3), SIMI engineers sought to design a system for an area with less water availability. Initially the village of Tori Danda was chosen, but when conflicts over use of the source arose, SIMI began construction in Senapuk instead. In Senapuk the idea of the double-tank, two-line distribution system was created and became the model after which many other MUS systems were built.

### COMMUNITY SETTING

#### Location and Climate

Senapuk is situated in Pelakot VDC of Syangja District on a south-facing slope about 200 m above the Andhi Khola River at about 800 m elevation. It is located about 50 km southwest of Tansen, the Syangja municipality, by road and 2.4 km walking distance from Galyang market. There is a fair-weather road from Galyang village to Senapuk but only a foot suspension bridge across the Andhi Khola, so most travel to Galyang village is on foot via a pedestrian trail (see the "fair weather road" Figure 4.1). Senapuk has an annual rainfall of about 1,800 mm with a distribution similar to that of a nearby climate station in Tansen shown in Table 1.2. Due to the uneven nature of the rainfall, there is little available water in the dry season. The dry hilly landscape of Senapuk can be seen in Plate 8.

**Figure 4.1 Schematic of Senapuk and surrounding area**




Courtesy of Robert Yoder.

## Population/Demographics

This community has been settled for many years. All the families are from the same caste (Brahman), and many are *pandits*[1] who have memorized a substantial portion of the *Vedas*.[2] The population of Senapuk has grown substantially since the 1980s, and there are now 36 households in the village, with a resident population of 235, making the average family size just under seven persons. Most men and many of the women are literate; one individual has a masters degree, four have bachelor's degrees, twelve have attained associate's degrees and fifteen have a high-school-level education.

## Socioeconomic and Food-Security Situation

The only industry in the village is a small diesel-operated mill. It is a household-based enterprise that provides rice-hulling service to the community but no employment beyond the owner's household. Instead, "service" jobs are the primary cash-earning activity in Senapuk. In Nepal, it is common for Brahmins to have service jobs—employment as teachers, staff in government offices, and in the private sector mostly outside of the community. For example, in one interviewed household the husband worked for the India railways for 40 years and had a retirement pension. Another Brahmin livelihood and significant income-generating activity in the community is the pandit work, performing religious services for both public and private events. Agriculture, on the other hand, was not a large cash income-generating activity in Senapuk prior to the MUS project, and food production was primarily subsistence. Therefore, despite the income from service work, the households in Senapuk had cash income levels below the average of farmers in their district.

The average annual income of Senapuk residents was estimated to range from $285 to $2,000[3] prior to the project while the average annual family expenditure was estimated to be about $570 with roughly one-third spent on food, one-third on education, and the remainder on clothing, health care, and other necessities. Those on the lower end of the income spectrum were often forced to take out loans, borrow, or barter to make ends meet.

Landholdings of the villagers range from 0.25 to 1 ha with two-thirds of the population farming 0.25–0.5 ha and one-third of the population farming 0.5–1 ha. A few families have biogas plants and use the manure from their livestock mixed with about 20 liters of water per day to create energy for cooking. They then use the slurry waste from the biogas plant to fertilize their fields.

Prior to project implementation, only 12 households produced sufficient grain for their annual needs; the other two-thirds of the households produced less than half of their annual cereal requirements. Sale of goats, ghee, and what little vegetables they produced without irrigation, as well as money earned outside the community as day laborers, were all income sources used to purchase additional grain.

## Pre-Project Agriculture

Before the MUS project Senapuk farmers had a traditional cropping pattern on their khet land as shown in "Cropping Patterns" in chapter 1 and used few, if any, external inputs. The khet fields are located a 20-minute walk below the village near the Andhi Khola River. In their bari fields near their homesteads, they grew rain-fed crops of maize, mustard, and lentils. The only vegetables farmers were producing were traditional ones like beans and leafy greens grown near the house in a bari field for home consumption. Senapuk households typically grow some bananas (some of which are sold), guava, mango, and jackfruit. Except for a new variety of mango introduced by a farmer who had worked in Calcutta, all fruits found in this area are local varieties and used primarily for household consumption.

Most farmers in Senapuk have similar soil types and use as much composted manure as they have available. They also use small amounts of commercial fertilizer and pesticides as inputs for their crops. During the period of project intervention, farmers were trained in Integrated Pest Management practices, so now local pesticides and insecticides are also in use.

All households in Senapuk have some livestock, but because it is a fully Brahmin village, poultry and pigs are not raised. Each household has at least one milking buffalo, and some households raise goats both for consumption and sale. In general, livestock contribute meat and milk to local families' diets as well as cash income. The whole village collectively sells about 50 liters per day of milk and about 200 kg per year of goat meat.

Villagers traditionally made ghee and sold it in the Butwal market. But in 1984 a milk-chilling center was built in Galyang, making sale of all milk more viable for Senapuk farmers. In 2004 the plant was privatized and eventually closed, forcing the Senapuk households to stop selling milk and revert to their original practice of making ghee. Thus, sale of ghee has again become a source of income.

As mentioned in "Migration, Remittances, and Income Inequality" in chapter 1, because agriculture on limited landholdings provides such low returns, many of the male population between the ages 20 to 40 leave the community for varying periods of employment. Numerous households in Senapuk have one or more members employed in India, and two households have members working in South East Asia and the Middle East. In total, 22 out of the 36 households have men working outside of the village (40 percent of the total male population). Consequently, in 70 percent of the households women are the primary vegetable cultivators. If all men stayed in the village, there would be underemployment. But for some households the work situation has shifted the balance toward a labor shortage during critical agriculture periods, causing some families to rent land out to balance labor availability. Traditional labor exchange (*parma*) is practiced for weeding and harvesting of cereal crops. And since Brahman households traditionally do not use bullocks for field work, they hire farmers from nearby villages to do their land preparation.

## INITIATION OF THE MUS SCHEME IN SENAPUK

In 2001 a program supported by Helvetas prepared an area master plan for water-related resource development that included Senapuk village. The plan mapped available water resources and set priority water needs; then, DDC and VDC officials found projects to meet the needs. The SIMI project provided the perfect opportunity to address Senapuk's water requirements.

Through the SIMI search for villages to implement MUS projects, staff contacted the DDC officials for information on villages in need in the area. SIMI was put in contact with the Senapuk VDC chairman who was looking for a partner organization for domestic water development in the village. SIMI explained the concept of MUS to the VDC chairman, who became very interested in partnering with SIMI, realizing the double benefit of the system.

When SIMI approached the Senapuk villagers with the VDC chairman, they were mostly interested in an easily accessible domestic water supply. In order to explain MUS to the community, SIMI took some of the Senapuk villagers to see the Chhatiwan scheme. The villagers observed the system and saw that farmers in neighboring villages were gaining cash income from irrigated vegetable production. Despite little prior access to microirrigation technology, they were interested in a scheme that would provide them with both domestic water and water for irrigation of cash crops, and the training needed to grow the crops effectively.

## WATER ACCESS PRIOR TO PROJECT IMPLEMENTATION

The previous drinking water scheme in Senapuk came about as part of a larger development project in the surrounding area in the mid-1980s called the Andhi Khola Project. The project components included a hydroelectric plant, a rural electrification program, irrigation, reforestation and erosion control, and the development of agriculture and employment opportunities. In the survey assessment of the area, it was determined that households did not have either a clean or year-round supply of drinking water, so a drinking water component was added to the program. For Senapuk, the Andhi Khola Project initially selected a spring called Chisapani to develop for domestic needs; however they soon realized that the elevation was too low to reach the village via gravity, and pumping was too expensive, so they decided to tap the nearby Dumkilla spring. The Andhi Khola Project implementers insisted that all households have a latrine prior to drinking water system construction, so 24 households built toilets. Once these were completed, a plastic pipe transmission line was built to deliver water to the village, where it was initially distributed through three public taps. Three more taps were added in 2000.

While the previous scheme had been a great improvement over walking to the spring for water, and output was sufficient in quantity and quality to meet daily domestic water needs at the time, the 0.2 lps flow rate that the Dumkilla spring provides became inadequate for the increase in demand by 2003. Since the upper settlement was the original village, they were using most of the water in the scheme before it reached the households in the lower settlement. So some villagers still needed to walk 30 minutes (about 700 m) each way to fetch water, and they faced an overall water shortage in the dry season.

Similarly to the domestic water system, Senapuk historically had access to irrigation canals for some of their khet land, but they had become unusable. In 1936 Mr. Laxmipati Patthak of Senapuk diverted water through earthen canals from the Dhap Pani Khola, a stream with steep banks located about 0.5 km west of the village, to a total of 1.5 ha of rice fields on both sides of the stream. Several years later a landslide destroyed some of the fields on the Senapuk side (the east side) of the stream and made it very difficult to maintain the canal leading to the undamaged fields. As a result, the formerly irrigated fields nearest Senapuk reverted to rain-fed cultivation.

Although Mr. Patthak did not have legal ownership over the springs or stream, his family had been using them for such a long time that they had prior customary rights. Therefore, when Mr. Patthak decided to sell the irrigated fields on the west side of Dhap Pani Khola to a farmer in the neighboring village to the west, the new owner attained the right to irrigate using the stream. The few households from Senapuk that have rice fields adjacent to the Andhi Khola River below the village and the few that have small rice fields below Senapuk village now use water from seasonal streams during the rainy season to irrigate.

## PROJECT PLANNING AND IMPLEMENTATION

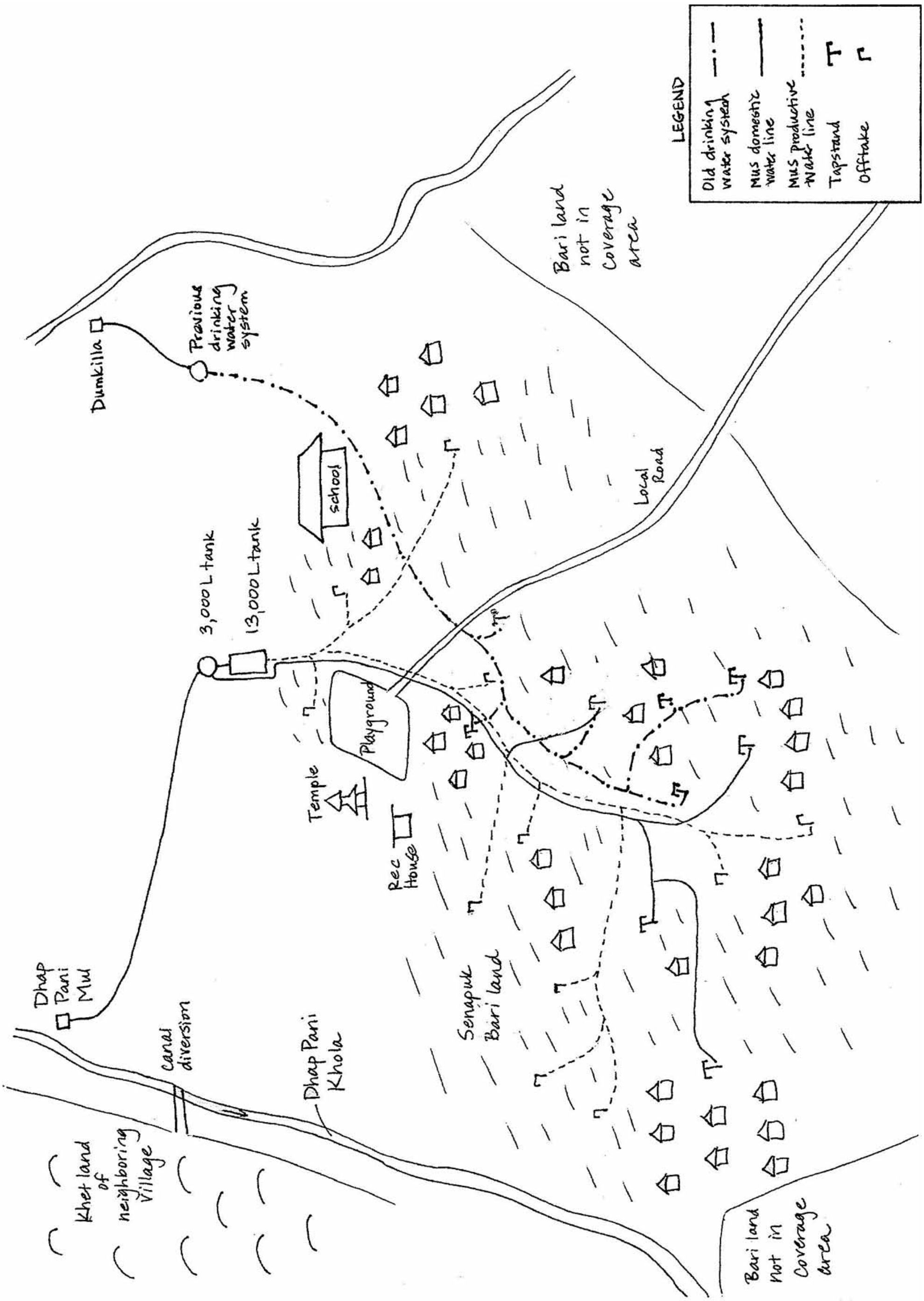
### SYSTEM DESIGN

#### Projected Water Needs

After the first meeting with SIMI, the community organized a construction committee by holding a meeting with one representative from each household, at which they elected seven committee members, three of whom were women. The initial task of the construction committee was to find an appropriate water source. In order to choose the source, the projected water demand for both domestic and irrigation purposes needed to be determined. The SIMI irrigation technician conducted a feasibility study in conjunction with members of the committee to map out the village, nearby potential water resources, the capacity of the existing domestic system, and the projected demand.

Because the existing water supply from six village taps was still working, it was incorporated into the plan for the domestic side of the new water service. It was planned that the 13 households nearest to the existing taps would

**Figure 4.2 Senapuk village schematic**




Courtesy of Monique Mikhail.

continue to use the old scheme for domestic water only,[4] and 23 households would use the new scheme for domestic needs. It was assumed that the new domestic supply would need to serve a ten-year projected population of 183 people by 2013, resulting in an estimated domestic water demand of 8,235 liters per day.

For the productive portion of the MUS system, SIMI engineers estimated the irrigation need for Senapuk farmers at an average of 600 liters/household/day for all 36 households (see "Project Implementation" in chapter 2 for design parameters) totaling a productive-use demand of 21,600 liters per day. This allows all Senapuk farmers to use a medium-size drip kit of 250 $m^2$ and apply up to 2.4 mm/day/$m^2$ to their fields.[5] Combined, the projected productive and domestic needs for 2013 were estimated to be nearly 30,000 liters per day.

It was estimated during the feasibility study that a total of about ten ha of bari land in Senapuk was suitable for vegetable cultivation. The houses are located on the edges of the bari land, and the vegetable plots in most cases are very near to the homestead houses (see Figure 4.2). However, there are multiple limiting factors for cultivating the whole bari. In the monsoon and postmonsoon seasons, land in addition to the fixed area irrigated by the microirrigation system can be cultivated by direct water application. Yet in the dry season the 600 liter/day/household estimated productive-use supply limits the total area that can be irrigated with microirrigation to about one ha (less area would be covered if microirrigation kits were not being used). To drip irrigate the entire ten ha would require about 200,000 liter/day. Based on the agreement reached with the source owner, even with the enhanced water availability through the MUS system and improved efficiency of application with microirrigation, there is only enough water available in the Dhap Pani Mul in the dry season to irrigate about one tenth of the available land without development of yet another water source. But no additional water source is easily accessible. As development of a secondary resource for additional irrigation was not economically viable, the MUS scheme kept the estimated demand of 600 liters/household/day for productive use.

## Water Resource Assessment

Using the estimated water needs and field information from the detailed engineering survey, the construction committee and SIMI team selected the appropriate source for their system, focusing on the perennial springs within the small Dhap Pani Khola catchment. At the beginning of the project the construction committee wanted to use a spring on the northeast side of the village because they believed its closer proximity would reduce cost. However, during the feasibility study the SIMI engineer found that the source on the northeast side was at an elevation below all but a few houses and would make the scheme infeasible without pumping, adding substantially to the cost. Alternatively, the Dhap Pani Mul spring on the northwest side of the village is the largest spring in the area and is 45 m above the village. Its minimum dry-season discharge of 0.4 liters per second (34,500 liters per day) is sufficient for the estimated 30,000 liters per day multiple-use demand. Therefore, although the Dhap Pani Mul spring was further away, it would provide the most reliable water source for Senapuk and allow for a gravity-fed system.

However, it was not easy to obtain the rights to use the Dhap Pani Mul. Several times in the past few years the villagers had approached the landowner who had access to the water rights acquired by Mr. Patthak to allow use of the Dhap Pani Khola stream for drinking water. The rights holder refused to give access even though Senapuk villagers still own the land on the east side of the stream and retain claim to water rights for irrigation.[6] Considering that the Dhap Pani Mul was the best option for the MUS system, representatives from the construction committee approached the rights holder again to discuss obtaining rights to the spring without jeopardizing his use of water from the stream. The negotiations were long and difficult, requiring many visits to the neighboring village. After each of the five negotiation meetings, the committee members reported back to the community and collectively planned for the next action. Although the process was grueling, it unified the construction committee and solidified the villagers' trust in their abilities. Ultimately, Senapuk offered to provide compensation to the rights holder in order to reach an agreement. A written statement was prepared and signed by both the committee and the rights holder agreeing to the following:

- Senapuk would not disturb the rainy season irrigation needs of the farmer;
- Senapuk would allow a continuous flow of water all year in the farmer's canal for livestock needs;
- Senapuk would provide ten bags of cement to improve the diversion and canal for the existing irrigation scheme to the fields on the west side of Dhap Pani Khola originally irrigated by Mr. Patthak and now irrigated by the rights holder in the neighboring village;
- Senapuk could install a collecting tank with a one-inch orifice at the spring to control the discharge going to Senapuk village;
- All remaining water was to be available to the rights holder in the neighboring village.

Once the agreement was signed, the construction committee informed the VDC of their agreement with the source owner to legally ensure usage and prevent any future disputes.

## Technical Design—Double-Tank, Two-Line Distribution System

After obtaining the right to use the spring, the construction committee focused their attention on effective system construction. Although SIMI already had the Chhatiwan experience of building a single-tank, one-line distribution system, they recognized that Senapuk had less water available than Chhatiwan,

**Figure 4.3 Intake from Dhap Pani Mul spring**

Photograph by Monique Mikhail.

raising the potential for conflict and underscoring the importance of safeguarding the domestic supply. While a larger single storage tank would have been the more conventional and cheaper approach, it would not have been able to ensure that productive-use demands did not exceed domestic-use needs. Instead, a two-tank system was envisioned such that only after the domestic tank is full does water get diverted into the irrigation tank. The uniqueness of this system lies in its dual function and the flexibility it gives the user committee: controlling the release in the domestic system determines how much overflows to the irrigation tank. This innovation became the first double-tank, two-line distribution system. With the new design, users would have separate control over distribution of water for domestic and productive purposes. Figure 2.2b in "System Components" section of chapter 2 shows a sketch of the double-tank, two-line distribution system that was ultimately designed. Despite the extra cost, the community appreciated the value of having full control over water distribution and protecting domestic water priority.

## SYSTEM CONSTRUCTION

The total construction period was 34 days, and all 36 households contributed throughout that period of time. Although both men and women participated heavily in the scheme, their roles were somewhat different. While women gave suggestions on the needs and problems of the scheme, they were not as actively involved in the planning and decision making as the men. On the other hand, women provided the majority of the labor for construction (55 percent), possibly due to the large number of men working outside the village.

The construction committee developed rules for carrying out the construction—organizing labor, collecting sand and stone for construction, and transporting pipe, cement, and other materials from the Galyang market to the village. In consultation with all users, the committee established a fine for persons who did not fulfill their construction duties. The fine was equal to the village rate for daily labor (roughly $1.00/day).

To begin construction, a collecting box (see Figure 4.3) was built to capture the seepage from the Dhap Pani Mul spring. A cover for the collecting box was not constructed even though the design called for one, because the community wanted to cut construction costs. As per the agreement with the rights holder in the neighboring village, a one-inch pipe is the outlet from the collecting box. A 32 mm-diameter high-density polyethylene pipe then transmits the water 570 m to the domestic water storage tank just above Senapuk village. With a 45 m elevation difference between the collecting box at the spring and the storage tank, the transmission system operates by gravity flow.

**Figure 4.4 Two storage tanks for Senapuk MUS system – domestic with productive overflow**
Photograph by Monique Mikhail.

Water from the transmission line fills a 3,000-liter Modified Thai Jar domestic water tank (Figure 4.4/Plate 9 jar-shaped tank), which overflows into a second 13,000-liter ferro-cement lined storage tank for productive use (Figure 4.4/Plate 9 rectangular tank). The domestic tank distributes water to three new hybrid tapstands (Figure 4.5a/Plate 10) built to complement the existing six taps from the old scheme. Two of the old taps were connected to the MUS system, while four of the old taps remain connected to the old system. Thus, there are now a total of nine tapstands servicing all 36 households. Location of the new taps was chosen by the construction committee to provide equal access to all new users with no more than 30 m walking distance from each home to the nearest tap. The productive tank distributes water to 11 irrigation offtakes near the farmers' bari land (Figure 4.5b) to which farmers directly connect their sprinklers or connect hoses to fill up their drip irrigation header tanks. Offtake locations were chosen by the user committee to minimize the distance to the users' fields. In addition to irrigation, these offtakes are used for livestock watering and often for all other household needs since they are closer to most houses than the domestic hybrid tapstands. The

**Figure 4.5a Using the hybrid tapstand**

Photograph by Robert Yoder.

amount of water each family is allowed to use from the irrigation system for domestic needs is determined by the users sharing the outlet. Although households are free to use their irrigation supply for domestic purposes, they do not use the domestic hybrid tapstands for irrigation because the tapstands are further from their bari land and it is too labor-intensive to carry all of the water necessary for irrigation from the tapstands to the fields.

As part of the agreement between the village and SIMI, at least 75 percent of the villagers had to indicate interest in purchasing microirrigation kits for cultivation of high-value vegetable crops (see "Project Implementation" in chapter 2). The SIMI team explained the purpose of the microirrigation kits: in the face of limited water availability, microirrigation technology enhances the area that can be irrigated. It can also decrease labor and fertilizer requirements and weed growth and increase yield and quality of produce. Seven different microirrigation kits were described to farmers and offered for sale by a vendor in the Galyang market (see Table 2.1 in "System Components" in chapter 2). It was up to each household to decide if it wanted to purchase the unsubsidized kits. Yet, despite access of all 36 households to irrigation

**Figure 4.5b  Irrigation offtake with hose attached to fill a drip header tank**

Photograph by Robert Yoder.

offtakes through the MUS system, not all households purchased the kits. Twenty-two households purchased 125 $m^2$ drip kits, seven households purchased 250 $m^2$ drip kits, two households installed 250 $m^2$ minisprinkler systems, and the remaining five households opted out of purchasing microirrigation kits, citing a problem of inadequate labor for usage.

## SYSTEM OPERATION

After the scheme was built, the villagers decided to convert the construction committee into a Water User Committee (WUC) to represent Senapuk village, but they kept the same members as the construction committee. They elected a chairperson, secretary, treasurer, and 12 additional members (of which two are female) to fully represent the village. The WUC continues to seek technical and financial support from NGOs and INGOs and long-term support from government organizations for all aspects of water resource usage in the village. They are also responsible for continued water distribution and all operation and maintenance activities.

A system operator was hired to manage the day-to-day water distribution. While the system was designed to provide all users with an equal water allotment, in practice the allotments are decided by the WUC according to the various needs and requests of the group members. The committee collectively decides the timing of distribution to each tap, and then the operator opens and closes the storage tank valves accordingly and monitors the system to ensure proper distribution. If disputes arise, the user committee and sometimes the whole village meets to resolve it.

Except in the dry months of the premonsoon season, the villagers have found that in addition to sufficient domestic water, they have enough supply to keep the irrigation distribution line open continuously as long as all taps are closed when not in use. This serves two much appreciated purposes. First, households closer to an irrigation offtake than a hybrid tapstand can draw their domestic water from those and save travel to the domestic tap. Since it is the overflow from the domestic tank that they are using, there is no danger that others' domestic needs are not being met. However, only the domestic tank has a tight cover so there is danger that water in the productive tank could become contaminated. Second, water close to the fields is available on demand for irrigation. In water-abundant months (October to February) farmers often use hose application for their vegetables.

In the dry season, system operation becomes less flexible. As mentioned above, 13 households still use the old domestic system, but in the dry season only three of the old domestic-system taps continue to function, forcing some households to use the MUS system for domestic purposes instead. Fortunately, even in the dry season the MUS system has enough water to keep the distribution valve on the domestic tank open continually. But the amount of water in the irrigation tank is insufficient to allow continuous distribution.

At this time an irrigation schedule of delivery twice per day (three hours in the morning and three hours in the evening) is instated and all households use their microirrigation equipment. Microirrigation allows them to maximize the use of limited water well above hose or flood irrigation application.

## SYSTEM COST

Senapuk village contributed not only in the planning and labor for scheme construction but also with materials like stone, sands, gravel, bamboo, local wood, etc. that were needed for construction. In total, the community contribution including labor totaled 49 percent of the scheme cost. They also purchased their own drip or sprinkler irrigation systems in addition to the MUS system contribution. On the other hand, the SIMI project paid for the cement, steel, plastic distribution pipe, skilled labor, and flexible pipe for each offtake to connect to the microirrigation header tanks (total length of distribution pipe for the whole community was 180 m costing NPR 2,160/$31). The total MUS system cost NPR 250,000 ($3,475), not including the microirrigation kits.

Since the community owns the scheme and is fully responsible for maintaining it, the Water User Committee took up an initial collection of $0.70/household to create a maintenance fund for repairs upon completion of the scheme. They also collect a fee of $0.15/household per month to build the account, accumulating to about $65 annually. The maintenance fund is only used to pay for material or parts that are not available in the village. Labor for maintenance is mobilized from each household as required in addition to the water-use fee. The operation and maintenance fund is used as a revolving loan fund in the village at a low interest rate.

## CAPACITY BUILDING

A major component of the MUS project is training villagers to care for the system, manage water distribution, grow high-value vegetable crops with microirrigation, and market the produce. Training sessions in Senapuk included all those listed in the "Training" section of chapter 2. On top of specific training provided to the villagers, community members gained skills through formation of the WUC, negotiation of water rights, and planning, construction, and maintenance of the system.

## MARKETING

The final essential component of the MUS project in Senapuk was linkage of farmers to their local market for sale of the vegetables grown with their new microirrigation kits. A broader network of vegetable production groups had already been established by SIMI in many VDCs of Syangja District. A coalition marketing committee comprised of representatives from each of the groups had been organized by SIMI for selling produce in Galyang (see

Plate 11). The marketing committee is responsible for setting the price of different commodities and linking with traders coming to Galyang from the town of Tansen in the west and the larger city of Pokhara in the north (see Figure 4.1). The management subcommittee of this marketing committee is responsible for selling the vegetables in Galyang and transporting some of them to Pokhara and other area markets. Senapuk farmers take their produce to the collection center in Galyang, where the marketing committee collects and weighs the produce and pays the farmers according to the daily price of that commodity. Although farmers can get a higher price by taking their produce directly to Pokhara themselves, the time and expense of transportation make the nearby Galyang marketing committee option a good one. However, farmers did mention problems with marketing and bargaining power, claiming that they were sometimes unable to obtain what they felt was a good price for their vegetables. The marketing committee needs to review and address these issues within the larger district context, and perhaps in the future, the community could diversify by focusing some of their efforts on vegetable seed production in addition to fresh vegetables.

In order to create an alternative to the Galyang marketing committee, the Senapuk WUC built a marketing center with SIMI's help along the road from Senapuk to Galyang. This enables some of the farmers to sell the produce closer to Senapuk and catch the traders coming along the road before they reach the market.

Once the MUS system was constructed and running smoothly, the households had purchased and installed their microirrigation kits, SIMI had conducted all trainings, and the marketing linkages had been made, SIMI staff made follow-up visits to help the WUC with any problems that arose in system operation and to help farmers with production advice. In fact, SIMI staff continues to visit Senapuk periodically to get feedback and provide technical support. Moreover, SIMI conducts exposure visits where they bring farmers from other district communities, government officials, and NGO partners to see the MUS system and vegetable cultivation in Senapuk.

## OUTCOMES

Village exposure visits are a great way for Senapuk farmers to share the story of their MUS system and the changes they have seen in their village since system construction. During the group interview in March 2007 the community was asked to rank the most important impacts of MUS. Their group conclusion was that increased drinking water availability was the most important improvement. Interestingly, the men in the village ranked nutrition and improved health as the second most important change, whereas the women thought that the increased income from vegetable production was the second most important outcome.

## VEGETABLE PRODUCTION

One of the most important impacts of the MUS project is the rise in vegetable production of the participating households. The increase in both crop variety and intensity has enlarged their income which helps them mitigate risk. Prior to the MUS project very few farmers in Senapuk were raising vegetables for sale; instead, most were growing a few vegetables for home consumption. With the construction of the MUS system and introduction of vegetable production techniques, farmers are now growing new crops. And, with the purchase of microirrigation kits, 86 percent are now growing these vegetable crops both on- and off-season, with the off-season vegetables fetching a higher price at local markets than during the on-season. Table 4.1 shows the average household vegetable cultivation in two crop cycles during the first year after MUS system implementation in Senapuk.

**Table 4.1: Average household vegetable cultivation in one year (two crop cycles) using MUS**

| Vegetable | Production (kg) |
|---|---|
| Tomato | 217 |
| Cauliflower | 207 |
| Cucumber | 187 |
| Cabbage | 83 |
| Bitter gourd | 42 |
| Bean | 20 |

**Total: 756**

Source: Personal interviews conducted in the second visit in October 2006 with six households, two from each category—poor, middle-income, and wealthy. There was no opportunity to cross-check to verify their recall responses.

Because they have more disposable income and greater technological awareness, they are purchasing more inputs, which further affects their yield and income gains. Farmers have shifted to using about 60 percent hybrid seed varieties, although seeds for beans, greens, and radishes are still local varieties.

There is opportunity for increased cropping intensity in the future. With the MUS system and microirrigation it is possible to grow three vegetable crops per year, depending on the type of vegetable. As the Senapuk farmers become more adept at growing vegetable crops, there is potential for equal production in all seasons if the crop varieties are selected correctly.

## HEALTH AND NUTRITION

Just as important to the villagers as income gains were the health improvements and abundance of vegetables in their diets. According to the villagers during the group interview in March 2007, additional domestic water has allowed them to practice regular personal hygiene. They claimed that because they are drinking more water on a regular basis, they are suffering fewer urinary-tract infections. And while 70 percent of the village households had toilets prior to MUS implementation, they did not have enough water to use the toilets at all times. Since MUS construction, the remaining 30 percent have built toilets, and all are using them regularly. All community members agreed that the incidence of illness had decreased since the MUS system was constructed.

Community members also claimed they felt healthier on the whole, and when asked why their health had improved, they directly linked it with consumption of fresh vegetables. Although data collected was not sufficient to prove enhanced health from vegetable consumption, the villagers' perception is that their health has improved because of the change in diet. With the increase in variety and quantity of vegetable production, consumption has also increased. The vegetables villagers were previously consuming were mainly beans and leafy greens which were added to their pulse curry, dry or pickled. After the project, they are consuming a larger variety of fresh vegetables per day. Household interviews indicated that roughly 20–26 percent of the total production is consumed at the household level.

The social value of vegetables has also changed due to the project. Prior to MUS system construction, the traditional gift that women gave to relatives during visits was homemade bread or bananas. Now, fresh vegetables are considered to be the most valuable gift they can give family members. This is likely due to the education they received about the health benefits of vegetable consumption.

However, one person indicated during the household interview that due to the increased production of vegetables, milk production in the village has decreased. She explained that the MUS system enables increased vegetable production, which makes it possible for her to do other work near to the house. Conversely, collecting fodder for her buffalo and cow requires going to the distant common land for several hours every day. With her husband working in India, it is easier for her to grow vegetables than take care of the livestock, so she has reduced the milking buffalo and increased work with vegetables. The vegetables can also be taken to the relatively nearby Galyang market for sale whereas in order to receive comparable prices for milk, it must first be made into ghee and then taken to farther-away Butwal for sale. Others during group interviews echoed her claim that there is less milk production in Senapuk than some years ago and much more vegetable production.

## FINANCES

Even though a quarter of the vegetables are consumed, there is still plenty for the farmers to take to market, and off-season prices are much higher than they are used to receiving. Ultimately, the project has been a financial boon for Senapuk farmers. On average, the annual net benefit of vegetable production (what was consumed plus sold minus cost of production) was $243 per household. Considering that most households had no vegetables for sale prior to the project, the net annual cash income increase per household was $199 (what was sold minus cost of production).

For farmers with steady sources of outside income, such as remittances or other employment, vegetable production does not represent the majority of their total income. However, for some without external aid, vegetable sales represent a major portion of their current income, on average, 30–40 percent.[7] For example, for one poor farmer, vegetable sales in the first year after the MUS project represented 50 percent of household earnings. Fortunately for most farmers, it has only taken six months to one year to recover the cost of their investment in the project through their new income.

Obviously farmers who were already wealthier with more land and resources were able to purchase more inputs and farm more land, thereby obtaining a greater output from their investment. However, the MUS project has leveled the playing field for community farmers by providing equal access to water for their crops and knowledge of production techniques, which provides the potential to increase production value and yield for all farmers more or less equally. Moreover, the income received by the poorest households makes more of a difference for their families because it represents a higher percentage of their overall income.

Additionally, the dynamics between the wealthier and poorer households in the village created by the MUS project are financially beneficial to the poorer households. First of all, some of the wealthier families in Senapuk decided that they could not contribute labor for the construction of the project, possibly because they have more family members outside of the village earning money. Due to their lack of ability to contribute labor, they paid poorer households to provide their share of the labor contribution for construction. Secondly, although some of the wealthier families owned and farmed more land, other wealthy families said that they were accustomed to purchasing vegetables and did not want to grow their own. Nonetheless, instead of purchasing them from the market as before, they started purchasing them from the poorer households in the village. This provided a market for the poor households within the village and reduced the time and energy spent carrying that produce to the marketing center or roadside stand.

Not only did the MUS project create new revenue streams for the poorer households, it also changed the power dynamic between them and the wealthier households. When questioned separately from the rest of the community, some of the poorest families commented that prior to MUS implementation they had to frequently take large loans from the wealthiest families. Now due to the income they make from their vegetable sales, they still have to take occasional loans from the wealthiest families, but at a much lower amount. This, they said, makes them feel more independent and less beholden to the wealthy in their community.

One future cost consideration for all Senapuk farmers is the lifespan of the irrigation kits. Although the MUS scheme was designed to provide adequate water for a ten-year projected population, the irrigation kits last only around three to five years. This will mean that if farmers want to continue receiving the benefit of microirrigation, they will need to replace their kits two or three times in the next ten years.

## TIME SAVINGS AND LABOR CONSTRAINTS

Another benefit from installation of the MUS system is the reduction of time spent collecting and carrying water each day for domestic needs. This has resulted in a decrease in school absenteeism, particularly among girls. As it is often women and young girls that are required to carry water, Senapuk villagers mentioned girls being able to fully attend school now that they no longer have to fetch water. According to the community group interview and observation by the SIMI irrigation technician and social mobilizer, about 20 percent of households were not sending their daughters to school prior to MUS construction, but now all girls in the village are attending school.

The benefit of time savings in domestic water collection is also an implicit financial benefit to the villagers. Each household is saving about 1.5 labor-hours per day because of the MUS system. Assuming that it is predominantly women's time being saved, this time savings equates to NPR 19 per day ($0.26),[8] about $100 per year.

The extra time women save on water collection is now being spent on vegetable cultivation, changing the nature of the domestic workload. And, since many men are working outside the village, vegetable production sometimes requires more time commitment than previous water collection, actually allowing women overall less free time. Although women in both the October 2006 individual household interviews and the March 2007 group interview said that they preferred to spend the time on cash-producing activity, they did reflect on their labor constraints because so many of the young men are employed outside the village. The women reported that since they are fully responsible for all aspects of household life, they are limited in the amount of production they can handle. So, the limiting factor in vegetable cultivation is lack of available manpower, not water shortage. Households with more available labor plant larger areas and the WUC has agreed to allow them use of as much water as needed, provided those that planted a smaller area do not suffer a water shortage. It is possible that as households continually see the financial benefits of vegetable cultivation, men may return to the village to cultivate increased area. However, it is too soon post-project for this sort of change to be observable.

## CHANGE IN GENDER ROLES

Another significant impact of the project was the change in gender roles. Consultation and joint decision making between men and women on farm activities has increased. And, because the household tap is now nearer to their homes, men have begun cooperating with women to perform household chores, particularly fetching water and managing livestock. Likewise, although women had always participated in cultivation, with vegetable production their role has significantly increased. And, for some families, women are doing all of the vegetable cultivation. Women also have started marketing for the first time, and have been a key factor in the rise in household income, which they claimed has made them feel more independent and confident. Since they are the ones predominantly responsible for vegetable cultivation and sales, they are freer to spend some of their money while in Galyang market selling their produce. They buy the essential items like cooking oil, salt, and sugar, but also personal items for which they previously had to request money from their husbands.

## CHANGE IN WATER-USE BEHAVIOR

An additional change for women was the abolition of a discriminatory cultural practice that existed around women's access to water. Due to the caste culture of the village, rules of "pollution" are very important, and when women are having their menstrual period, they are considered "unclean." They are not allowed to cook for their husbands during menstruation and after it ends they must bathe and wash their clothes before they are again considered "clean." They were not allowed to use the previous drinking water system taps for this purpose, but instead were required to go to the stream, which was a half-hour walk from the village. The project overseer refused to continue with the MUS project until this discriminatory practice was abolished which resulted in an animated community discussion. In due course, a decision was made that women would be allowed to collect water and bathe at the tapstands during menstruation so that project work could commence.

Yet, women's water use was not the only change for the village. The behavior of the entire community in regards to water conservation was also transformed. As the Senapuk community gained experience in operating both the domestic services and irrigation delivery of the MUS system they collectively modified the rules for water distribution. They found that there was usually sufficient water available for continuous water distribution in the domestic service line provided all taps were closed immediately after drawing water. It is common in the middle hills of Nepal to see domestic taps left open and running continuously. Closing taps after drawing water is an acquired habit that requires reminders and discipline. However, while visiting the village and observing the tap near the school where children gathered for a drink of water while playing, it was noted by international staff that they carefully closed the tap after each drink of water. After this observation, it was discovered that not a single tap was left open in the entire tour of domestic taps in the village. It is likely that the connection was made in the village that by shutting the domestic taps when not in use, more water would be available in both tanks. Therefore, they have been able to modify their own behavior to realize the full benefits of the MUS system and have a significant amount of water available in this moderate water supply region.

## SYSTEM IMPROVEMENTS

While their behavior changed in regards to women's water access due to encouragement from SIMI staff, not all suggestions were received as conclusively. In several visits to Senapuk, SIMI staff noticed that the intake remained unprotected. Although the villagers were encouraged each time to collect the money necessary to provide a cover for the source intake, they have not yet taken the initiative. Partially due to this experience in Senapuk, source protection has become more advanced as the MUS projects have evolved in the past few years. For example, for the system in Lele village of Lalitpur District sand filtration tanks were built at the intake. Senapuk's lack of movement on this front indicates that the water quality information given through the trainings is not compelling enough for them to spend the extra cash on a cover.

On the other hand, there were other system improvements that the villagers did think would be useful along with problems they would like to solve. While meeting with the whole village community in 2007, there were a few suggestions for improvements to the system. Villagers mentioned that there was no provision to wash out the two water storage tanks. They also said that a problem with lime buildup in the tapstands was causing blockage, so regular cleaning of the pipeline was suggested as a low-cost solution. Furthermore, it was suggested that tapstands for future MUS systems be constructed with reinforcements to make them more durable. The community felt that they were somewhat weak because a drunk resident had been able to break one of the hybrid tapstands when he kicked it. In this instance, the man damaged the newly built structure when the concrete was still setting and not yet solidified. But, this created a perception within the community that the tapstand was weak.

## CONCLUSIONS AND LESSONS

There is no doubt that the MUS system has brought positive change to Senapuk. The increased availability of domestic water has improved the health and hygiene of the villagers. The availability of irrigation water to make productive use of their bari land has enabled them to grow new vegetable crops, plant in the off-season, and receive higher levels of income. It has also increased their consumption of fresh vegetables and improved nutrition. And, although some reduction in milk production is expected with increased vegetable production, caution should be taken not to completely remove milk production from village activities. Both the existence of milk in their diets and the diversification of income sources from ghee production are important and must not be removed. Education given as part of future MUS projects should touch on the importance of these aspects of maintaining livestock.

Perhaps most strikingly in Senapuk was the emphatic declaration of women in the village that their sense of independence has improved dramatically from the system due to vegetable cultivation and marketing. Considering that the resident male population in many hill districts is decreasing, and the focus of development aid on improving the condition of women is strengthening, this change for Senapuk's women from their MUS system has dramatic implications. Furthermore, increased school attendance by girls only underscores the sustainability of MUS' positive impact for future generations of women. In order to fully actualize the benefits of MUS for women, more emphasis should be placed on their representation in WUCs and marketing committees and greater inclusion in the planning and decision-making phases of MUS projects. More care must be taken in training women heads of households in vegetable production, particularly if they are among the poorer households in the community. Additionally, since labor was cited as the limiting factor for increased production and as the reason for lack of purchase of microirrigation by some households, alternatives should be sought to this problem, such as loans for hire of additional labor. On the other hand, although water does not currently seem to be a limiting factor, if enough water were made available to irrigate all of their land, it could potentially make their farms financially viable to the point that the men would no longer need to work abroad and send home remittances. If this were the case, the labor shortage would no longer be an issue.

Despite a net annual cash income increase per household of $199, farmers felt that they were not always receiving the highest possible price for their produce. These marketing difficulties echo those of Chhatiwan Tole and are being mitigated in similar fashion. As mentioned above in the Chhatiwan case study, SIMI is now strengthening the dissemination of market information and creating apex marketing committees at the district level to help the smaller committees reach broader markets.

As for other communities in the hills with scarce to moderate water supply, the Senapuk case lends many lessons about source negotiation and equitable distribution. Negotiating for rights to water resources with surrounding communities and previous rights holders is critical for the success of MUS projects, and often takes patience, compromise and persistence. It also takes knowledge of the customary water rights and legal water rights in Nepal. In order for a MUS project to proceed, the community must obtain legal rights to the water source, which in turn requires them to be organized into a WUC. These formal steps are key to not only developing the ability of the community to organize themselves and negotiate as a unit, but also follow the formal legal steps to establishing their rights. As water resources come under increased demand in the future, these skills will be invaluable.

Yet, just the ability to use a source is not enough for all to have equal access. Ensuring the priority of domestic use over productive use through the system design and working together within the WUC to establish rules of operation for water allocation were essential in making maximum use of a moderate water supply and reducing the possibility of intra-community conflict. Ultimately, the double-tank, two-line distribution system was an innovation that was copied for areas with scarce to moderate water supply throughout the hills of Nepal.

Unlike the single tank model, those using the double tank model should be aware of the difference in water quality between the two. Because the productive-use tank does not have a cement cover, the water inside it is more susceptible to contamination. Although the system is designed to provide water for domestic use solely from the domestic tank and water for productive use solely from the productive tank, some families who are closer to the offtake than the hybrid tapstand use the offtake to get water for domestic use. The potential difference in the water quality in the two tanks should be made apparent to these households. And, if some households wish to use the offtakes for domestic purposes, the community should be able to decide during the design phase of the project if they wish to spend the extra cash for a cement cover on the productive tank. Alternatively, SIMI could work with the community to better site hybrid tapstands such that all households have closer access to their domestic tap than the irrigation offtake. Unfortunately, with the variance in location of bari land in relation to homes, this is difficult to ensure.

Although the future sustainability of the system has yet to be seen, there are many factors indicating that sustainability is likely. The community owns the MUS system from project initiation and makes all decisions collectively. They are raising the funds for operation and maintenance, are investing collected funds, and making all decisions upon their use. Additionally, for the first time, farmers are cultivating vegetables as a cash crop, which has increased their annual income. The income-generating nature of the system helps to ensure that households will put the time, effort, and finances into its future operation.

The development of the double-tank, two-line distribution system in Senapuk grew out of the need to ensure domestic supply in the dry season for this region of moderate water availability. As will be seen in the Krishnapur case study, an even more scarce water situation led to a different system innovation.

CHAPTER 5

# KRISHNAPUR: SCARCE WATER

Photograph by Robert Yoder.

The Krishnapur Tole cluster within the village of Karre Khola in Surkhet District was chosen as a case study due to the unique MUS situation that arose from the area's incredible water scarcity. Information in this case study came predominantly from personal interviews of nine out of the 16 households and small-group interviews from the whole cluster in October 2006. Of the nine households interviewed, three were from each part of the MUS system—head, middle, and end, and within each group of three were one poor, one middle-income, and one wealthy household. Additional information was obtained from the detailed survey design report conducted by SIMI staff prior to MUS construction.

## SITUATION ANALYSIS

### COMMUNITY SETTING

#### Location and Climate

Karre Khola village sits between two streams, the Karre Khola on the east and the smaller Bhandari Khola on the west (see Figure 5.1) that join at the lower end of the valley. The village, named after the larger stream, is northeast of Surkhet municipality (Birendranagar) at an elevation of about 760 m. The village has 356 households spread in a narrow band along a one-km stretch of road leading from the valley up the hill to Ratu VDC. A six-km gravel road links the village to both Birendranagar and the road leading to the Terai in the south of Nepal. However, there is a more direct foot trail that takes only one hour to the municipality, so most travel and transport to and from Karre Khola village is by foot.

The Karre Khola stream has a steep uniform gradient (80 m drop in 1,000 m) near the village with nearly vertical banks cut 10–20 m into unconsolidated rocky soil. Although there are perennial springs that feed the stream in some areas, it is not large even in the monsoon season and has very little water in the dry season. This leads the entire Karre Khola valley to be very water scarce in the dry season, from about February until monsoon rains start in June. Table 1.2 in chapter 1 shows the rainfall patterns, temperature ranges, and evapotranspiration rates for Krishnapur.

A 76-year-old resident of the village, Mr. Tek Bahadur Mager, who has lived all his life in the area, described how the heavily forested valley had very few permanent residents when he was young. Since malaria was endemic in the valley, most households made their permanent houses above 1,000 m, the upper elevation range of the Anopheles mosquito, on hills surrounding the valley. They made the long walk (one or more hours each way) to their farms in the valley to cultivate rice and other crops and tend to cattle. Many kept temporary huts near their fields where they could stay overnight when necessary. As malaria was reduced in the period 1950–1970,[1] many families with fields in the valley moved down from the higher villages, and Karre Khola became more established.

### Population/Demographics

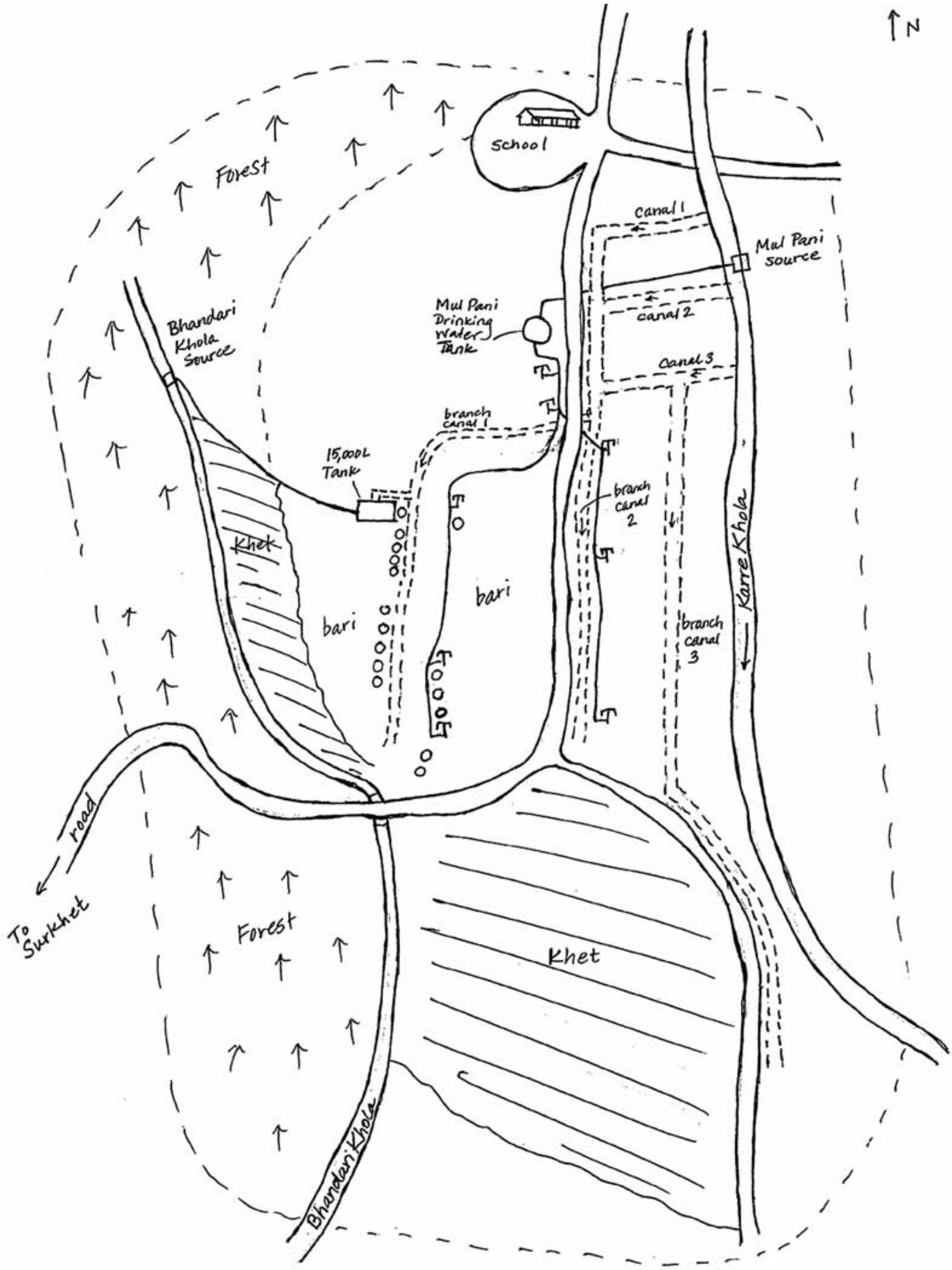
The whole Karre Khola village has 871 males and 1,447 females, totaling a population of 2,318. The village is a mixture of Magar, Brahman, Cheetri, Kami, and Damai ethnic groups within the Hindu religion. In addition to village members who shifted residence over time from high on the nearby hill to the valley, many others have migrated in from nearby districts of Dailakh and Jumla over time. Krishnapur Tole is one neighborhood within the Karre Khola village which lies along the westernmost branch of the three-branch Karre Khola irrigation system described below (branch canal 1 shown in Figure 5.1). The 16 households in Krishnapur Tole—47 males and 49 females, for a population of 96—reflect the same demographic mixture as the larger village and have an average family size of six people. The literacy rate among the household sample is fairly high, about 70 percent. Only individuals over 50 are illiterate. Moreover, secondary-school attendance is high because the village has a secondary school, eliminating the need for children to leave the village for education.

### Socioeconomic and Food-Security Situation

The major income-generating activities for residents of Krishnapur Tole are service work, such as employment by the government, an NGO, and private business employment, trade, and agriculture. Four of the nine surveyed households had income from service work, comprising 31–100 percent of their total income with agriculture,[2] making up the remaining portion for two of them and trade forming the remainder for one household. Three of the nine surveyed households made a substantial amount (61–69 percent) of their income from trade in cottage industries like weaving local *radi*[3] and *pakhi* (carpet). For two of the three, the remaining portion of their income came from agriculture. The third household is the only one that received income from both services and trade and did not have agricultural sales. The remaining three of the nine households received 100 percent of their income from agriculture, largely from sales of goats, ghee, and milk. The annual gross income of sampled households prior to the MUS project is NPR 9,100–NPR 106,375 ($126–$1,477) per year. Unlike Chhatiwan and Senapuk, none of the households in Krishnapur receive remittances or pensions.

Household expenditure among the nine sampled households is NPR 8,200–NPR 52,000 ($114–$722) per year. Household expenditure for social and religious obligations (for example, marriages, Dashain festival, and funerals) is the largest financial outlay, averaging about 30 percent. This is followed

**Figure 5.1 Karre Khola village schematic**




Courtesy of Monique Mikhail.

by food purchase, education, and healthcare (doctor visits and medicine). Some years households have a deficit budget with insufficient money even for food or social activities such as marriages or religious ceremonies. In these instances, the households are forced to take out loans from a local moneylender or from a community group. Local NGOs have been actively working in the area with communities like Krishnapur Tole to organize a range of activities: women's savings groups, vegetable production groups, and forest-management groups being the most common. Many of these groups have savings schemes where members contribute a small amount into their savings account each month. The savings pool is then used as a revolving fund for short-term loans with an interest rate much lower than other locally available options (18 percent vs. the local private-lender rate of 24 percent or more).

The average landholding of this village is about 0.5 ha, 80 percent khet and 20 percent bari. The khet land is some distance down the valley from the village settlement, whereas bari land is located next to the houses. In the sampled households, five out of the nine can grow enough grain to meet their household needs all year. The remaining four households had a four- to five-month period during the year when they did not have sufficient grain and used their cash income to purchase necessary foodstuffs or exchanged labor for food.

### Pre-project Agriculture

Cereal production for household consumption was the primary crop cultivation before the MUS project (see "Cropping Patterns" in chapter 1). Only one household of Krishnapur Tole was able to grow enough potato, onion, chili, and garlic for sale at commercial markets prior to the project. The remaining farmers grew a few traditional rain-fed vegetables for home consumption. Most farmers have similar soil types and use fertilizer, pesticides, manure, and compost as inputs for their crops. Prior to MUS implementation, seed varieties used were predominantly local.

The cluster of Krishnapur Tole has buffaloes, cows, and goats, with an average of five animals per household. Livestock provide families with meat, milk, and income. As mentioned above, sales of livestock and livestock products are a significant source of income for Krishnapur farmers: three of the nine sampled households sold live goats, two sold milk, and two sold ghee in the year MUS was constructed. Income from goat sales was NPR 4,000–NPR 40,000 ($57–$571) whereas milk sales were around NPR 10,000 ($143), and ghee sales were NPR 700–NPR 5,000 ($10–$71).

## INITIATION OF THE MUS SCHEME IN KRISHNAPUR

In mid-2003 SIMI project staff based in Birendranagar selected three VDCs in the area for potential MUS projects and contacted a local NGO, the Social Awareness Campaign (SAC), to find out more about the villages there. SAC had a well-established connection with the Karre Khola VDC through their prior work on a goat-exchange program and shared their village level data with SIMI. Upon reviewing SAC's data, Krishnapur Tole cluster in Karre Khola village emerged as a potential group to work with. SAC had previously helped the 16-household cluster within this farming village to form a production group and register with the DADO as the Narayan Hari Farmers Group. The group of farmers wanted to form a production group because they shared one branch of an existing three-branch irrigation system and wished to work together to increase their production.

Although by 2003 SAC was no longer working with Krishnapur Tole, another local NGO, the Environment Development Society (EDS), had become closely associated with the group. SIMI staff met with EDS and asked them to facilitate an introduction with Krishnapur Tole. SIMI held a meeting with the residents of Krishnapur Tole and discussed their water situation to determine what type of system might work best for them.

## WATER ACCESS PRIOR TO PROJECT IMPLEMENTATION

Prior to 2001 there was no piped drinking water system in the Karre Khola village. Water had to be carried from springs, many of which are seasonal, forcing villagers to make an hour long journey in the dry season to obtain water from one of the perennial springs along the Karre Khola streambed. Some had to make this journey twice per day to get enough water to fulfill their domestic needs.

In 2001 the government's Rural Water Supply Program worked with the Karre Khola villagers to construct the Mul Pani drinking water system. The system, which serves the entire Karre Khola village, comprises a covered collecting tank at one of the larger springs near the Karre Khola streambed and a gravity pipeline to deliver water to a 25,000-liter storage tank (Figure 5.2) at the upper end of the village. Drinking water is piped from the storage tank to 26 village tapstands and one private connection, which resulted from a negotiation for land to build the storage tank. Three of the village tapstands and the private connection are located in the residential area of the Krishnapur Tole cluster. The households sharing each tapstand collectively pay NPR 30 ($0.42) per month for system operation and maintenance.

The system design is such that once the domestic storage tank is full, any additional water is directed through an overflow pipe directly into the distribution system. During the rainy season, the domestic water-storage tank fills at night, and each morning the tank valve is opened for two hours, during which the community can get water from the tapstands to suffice all of their domestic needs. During this peak-flow season, the storage tank will again fill after the two-hour morning usage and overflow directly to the tapstands, allowing households to get additional water in the afternoon.

**Figure 5.2 25,000 liter Mul Pani drinking water tank**

Photograph by Ryan Yoder.

However, during the dryer times of year the delivery from the spring is greatly reduced and the storage tank does not fill. At these times there is only enough water to fill the taps for about an hour per day, giving barely enough water just for drinking. Long lines form at the taps. and there is often conflict over water access. Residents are not allowed to bathe, do laundry, or water their livestock at the tap during this period, and instead they must walk to the Karre Khola river for those activities.

Unlike the domestic water situation, irrigation infrastructure had existed in Karre Khola for almost a century. In the period from about 1910 to 1915, farmers in the valley worked together to divert the Karre Khola water from the streambed to their fields. The farmers' primary objective was to irrigate their khet located below the village, as this is where they cultivated rice, their staple grain. Three small canals were built with intakes about 100–200 m apart along the Karre Khola to capture water from different springs. It is the springs along the stream that recharge the stream flow and make it possible to extract water at multiple locations. The three canals then combine into one channel for some distance through the village, after which they diverge to serve separate areas of khet fields (see Figure 5.1). The Karre Khola stream is also used for irrigation by other villages both above and below Karre Khola village.

The Karre Khola farmer-managed irrigation system is carefully administered by the Mulpani Belkulo Water Users Committee. Each year the farmer leaders of the committee call a mass meeting, which all irrigators are requested to attend. In addition to electing leaders and standing committee members to manage the system, they discuss the rules for operation and maintenance and the roles and responsibilities of elected officers, committee members, and hired staff. The elected canal committee then meets periodically to discuss and determine operation and maintenance tasks.

Water from the irrigation system is allocated to the khet fields on the basis of land area: one hour of water from one of the branch canals allocated for every 667 $m^2$ in the rainy season and two hours for every 667 $m^2$ in the dry season. While volume of water in the canal system is sufficient to provide equal and continuous flow to each of the three branches during the rainy season, there is not enough flow for each farmer along each branch to take water simultaneously. Therefore, water distribution is rotated within each of the three branches, sometimes leading to disputes among farmers. Equal discharge for continuous flow in each of the three branch canals is accomplished by adjusting the gates where the canals are divided, and distribution of the water to each rotational group is monitored by a *chokidhar* (watchman)—a hired employee given authority to enforce distribution decisions.[4] The chokidhar is responsible for determining need and allocation. For example, if farmers in one area are harvesting their crops, the water to their area may be cut off to allow water for farmers who are still cultivating. Within each rotational group the farmers themselves are responsible for monitoring the length of each person's turn to receive water, but they can appeal to the chokidhar if there are disputes. When the discharge is low in the dry season, water distribution is rotated from one branch to the next instead of having continuous flow in each branch.

In 2001 the Mulpani Belkulo Water Users Committee appealed to the DoI for assistance in strengthening their system to retain a greater amount of water. Between 2001 and 2003 the DoI improved the diversions from the stream with gabion structures and lined the main and branch canals, using cement masonry (shown in Plate 12), resulting in less water loss at the diversions and through seepage.

## PROJECT PLANNING AND IMPLEMENTATION

### SYSTEM DESIGN AND CONSTRUCTION

Shortly after completion of the 2001–2003 canal lining project by the DoI, SIMI approached the Krishnapur Tole cluster to see if they would be interested in working on a project together. SIMI was impressed with the experience of the group in water management. As a subunit of the larger Karre Khola irrigation system, members of the Krishnapur Tole cluster had a long history of working together to manage the distribution of water from their sub branch and represent their interests to the larger-system members. At the initial meeting with the group, SIMI explained their microirrigation work,

**Figure 5.3a 15,000 liter MUS storage tank**

Photograph by Ryan Yoder.

**Figure 5.3b MUS settling tank**

Photograph by Ryan Yoder.

and the group mentioned the recently completed lining of the canal. Due to the canal lining, the Krishnapur Tole water delivery turn from branch canal 1 would be increased by 16 hours during the dry season. Since the branch canal leading to the khet fields passes through or near to the bari land on its way downhill, they were interested in SIMI's proposition to use this extra water for vegetable cultivation on their bari land.

Krishnapur Tole farmers had been formed and registered with DADO as the Narayan Hari Farmers Group prior to SIMI involvement and were responsible mostly for water distribution from their outlet from the branch canal 1 and for production marketing. Once the partnership with SIMI was made, the group reelected members to their seven-member (with two female members) committee and changed their name to the Krishnapur Off-season Vegetable Group (KOVG). In addition to their traditional vegetable production function, the KOVG set up a community bank to support village development projects and became responsible for planning and construction of the new water-distribution system.

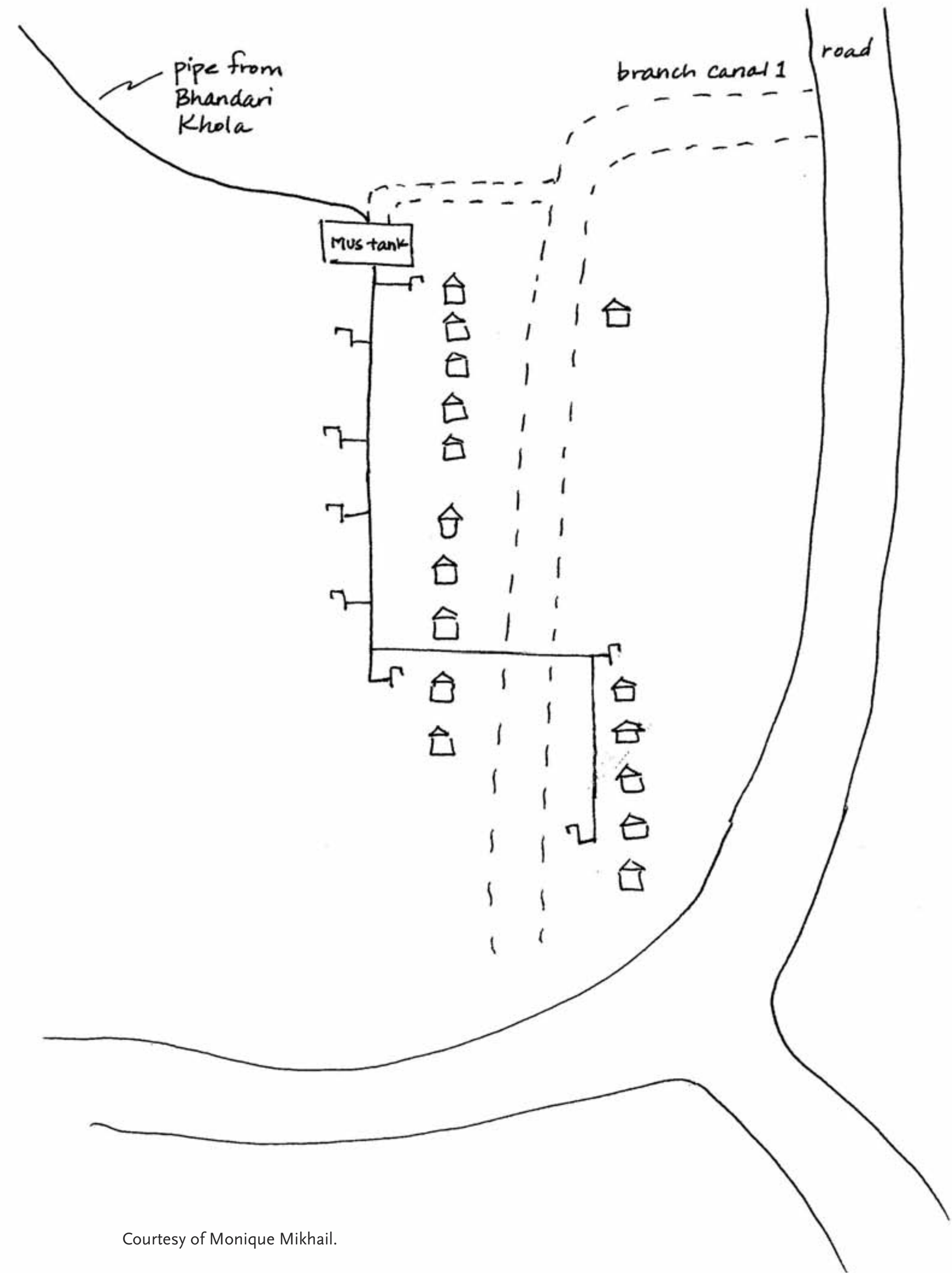
In order to better deliver the extra canal water, a 15,000-liter storage tank (Figure 5.3a) was constructed at the upper end of the Krishnapur area that could be filled by gravity flow from their branch canal 1 outlet. A settling tank (Figure 5.3b) was built for the water to flow through on the way to the storage tank. The settling tank removes sand and silt that could block microirrigation-system emitters. Eight irrigation offtakes were built near the households' bari land, and for the first growing season water was delivered from this storage tank directly to the offtakes (see figure 5.4). Households purchased one of the seven available microirrigation kits described in Table 2.1 of "System Components" in chapter 2.

The extra 16 hours of water distribution was originally planned to be delivered every seven days, but due to low flows in the Karre Khola in the first dry season of operation, the time between deliveries of water had to be lengthened to serve all the fields in the canal system. Thus, the KOVG found that they were only getting their extra water every 10 to 14 days. Since vegetables require more frequent irrigation, more water storage was needed for better control.

Two options were considered for increasing the water storage. The first option was to increase the size of the tank receiving water from branch canal 1, which would make the volume of water delivered to each homestead a collective-action decision. In SIMI's experience, controlling the delivery as a group works well when the supply is adequate for frequent delivery to each farmer with all farmers on the same irrigation schedule. However, Krishnapur farmers grow different crops requiring various amounts of water at different times, making it difficult for a unified water-delivery system from one tank to meet their needs.

The second option was to build additional storage at each homestead where each household could decide independently how to allocate the water among competing needs. Although the Krishnapur project had originally

**Figure 5.4 Krishnapur Tole schematic**




Courtesy of Monique Mikhail.

been conceptualized solely as an irrigation project due to the quality of the canal water, the SIMI team was constructing other MUS projects at the time and realized that the Krishnapur system could become a MUS system and provide all water needs except for drinking. With homestead storage it would be possible to achieve equal water delivery to each household, providing the farmers with irrigation-scheduling flexibility and at the same time creating easy access to water for all domestic needs other than drinking.[5] The use of homestead storage water for bathing, clothes washing, and livestock watering would reduce the need for the long walk to the stream for those tasks and reduce the water collection from the Mul Pani drinking water system taps for toilet flushing, hand washing, dish washing, etc.[6] It would also take pressure off of the Mul Pani drinking water system by shifting most of Krishnapur's domestic water-use demand away from that system. When SIMI explained to the KOVG the possibilities of the homestead storage option, the group members decided it was worth the extra cost because it gave them much more flexibility for using their water and provided domestic water near the home.

To create this homestead storage, all but one participating household (that has bari in Krishnapur Tole but its home elsewhere) built either a 1,000- or 1,500-liter Modified Thai Jar storage tank next to their offtake (Figure 5.5 and Plate 13) so they could easily fill the tank from the offtake. They use the water in their storage tank to fill the drip irrigation header tank to irrigate their vegetable plots (see Plate 14) and for domestic uses other than drinking.

The homestead storage serves several purposes. It allows the men and women in each of the benefiting households to capture any overflow from the primary storage tank in periods of excess water flow in the first few months after the rainy season. It also improves equitable distribution during the driest time of the year when every drop of water is precious. The primary purpose, however, is to give each household flexibility in how they use their limited water supply. They can individually determine how much they wish to allocate for productive versus domestic uses and vary it without time-consuming group negotiations. It also gives them flexibility in the timing and application rate for irrigating their vegetable plots in a situation where frequency of water need for vegetable plots is greater than frequency of water supply delivery down branch canal 1.

Although most households fill their homestead storage from the canal system for productive use and domestic needs, there are a couple of households that chose to use their resources differently. The household that owned the land where the Mul Pani drinking water system tank was constructed had been given a direct household connection to the distribution network as compensation for the land. This household decided to use its Thai Jar storage tank for domestic water only and connected it to the Mul Pani drinking water network instead of the MUS network. Except for the driest few months,

**Figure 5.5 Farmer displaying his homestead storage and nearby offtake**


Photograph by Ryan Yoder.

this 1,500-liter tank fills during the daily community-wide domestic water release and reduces the household's waiting time at the public tap. Another household fills its storage tank from the Mul Pani drinking water tap located near its house and uses it for all domestic purposes. For irrigation, this household waits until all other users have filled their tanks from the nearest MUS offtake and then connects a hose to the offtake directly to the drip irrigation header tank to fill it, supplementing with storage water if necessary.

Water is delivered to the homestead storage tanks by releasing it from the main tank at intervals decided by the KOVG, enabling each offtake to receive water simultaneously. Since there is a considerable slope from the main tank down through the Krishnapur Tole area, flow regulators were installed and adjusted to provide the same flow rate at each offtake. Each offtake is shared by two households, which take turns filling up their storage tanks, ensuring equal quantities of water to each household.

Even after construction of homestead storage, Krishnapur Tole had problems during the period of extreme water scarcity from about April to mid-June. Therefore, Krishnapur Tole lobbied SIMI to augment the canal-water supply as part of the MUS project. The Krishnapur cluster found a small spring about 400 m away in the Bhandari Khola stream on the western side of Krishnapur (see Figure 5.1) that was not yet utilized by another community. They registered use of the new source with the VDC to secure the formal rights to its use. Although the water from this spring was clean enough for drinking, there were a couple of reasons it was not combined with the Mul Pani drinking water system. First, it was unfeasible because the new source was at a lower elevation than the Mul Pani storage tank and would require either a pump or new tank. Secondly, the Krishnapur Tole cluster was both at the end of the Mul Pani system and already demanding less domestic water from it than other Karre Khola villagers due to their homestead storage. Since they were mobilizing the resources for developing and delivering the spring water, they could use the extra water just for their cluster. Hence, SIMI and the KOVG tapped the spring and piped the water by gravity to the main MUS storage tank.

With the additional water, the MUS system had enough to supply all of the nondrinking domestic needs and the productive needs of Krishnapur Tole cluster even in the dry season. Construction of the whole MUS system including main tank, offtakes, homestead storage, and the piped spring enhancement took 11 months. And although all households contributed an equal amount of labor for system construction, women were the major contributors, supplying two-thirds of the total labor.

## SYSTEM OPERATION

After construction of the MUS system was completed, the KOVG transitioned into the Water Users Committee (WUC) and reelected nine members, five of them female. The number of female members was increased because it was largely the women who were responsible for vegetable cultivation with the microirrigation kits, and SIMI had encouraged them to have more female representation. The WUC is now responsible for operation (including allocation and distribution decisions) and maintenance of the MUS system. The WUC chairperson operates the MUS distribution system to the offtakes and ensures that each household receives an equal amount. Although he is not paid for this responsibility, his house is near to the water tank, making it more convenient for him to function as overseer.

Because the primary water supply for the Krishnapur WUC is from the existing irrigation system, families are still required to pay annual user fees for that water, costing NPR 739 ($10) per hectare for irrigating khet and NPR

370 ($5) per hectare for irrigating bari. The Krishnapur WUC collects these user fees and gives them to the Mulpani Belkulo Water Users Committee. Krishnapur Tole members also contribute maintenance labor to the Karre Khola surface-irrigation system.

The Krishnapur WUC also collects NPR 10 ($0.14) per month per household for a savings fund. This WUC fund is used for repair and maintenance of the Krishnapur Tole MUS system as well as community lending.

## SYSTEM COST

The individual households of Krishnapur Tole cluster ended up contributing more financially than other communities constructing MUS schemes. Households in other communities with MUS schemes contributed labor, local materials, and sometimes additional cash for their systems as well as purchasing their own microirrigation kits. But Krishnapur Tole members ended up shouldering most of the cost of building homestead storage in addition to these other costs. SIMI hired a skilled mason to construct the household storage tanks, costing about NPR 800 per household for his wages, and each household covered the remaining NPR 3,200 ($46) of the NPR 4,000 ($57) per Thai jar storage tank. The total cost of the project was NPR 90,787 ($1,260), not including the individual-homestead storage tank costs. SIMI paid for the construction material, skilled labor, and flexible pipe for each offtake (total length of pipe for the whole Krishnapur cluster was 160 m costing NPR 1,920, $27). The KOVG provided all local materials and unskilled labor valued at about NPR 26,000 ($361, $22.50 per household) or 25 percent of the total cost. When the costs of the microirrigation equipment and Thai jars are included, the Krishnapur cluster's share of the total cost comes close to 40 percent.

## CAPACITY BUILDING

Although members of Krishnapur Tole had been part of an organized canal-irrigation system for a long time, that system was designed for just cereal production. Krishnapur Tole members had little knowledge of vegetable cultivation and only basic knowledge of water resource management. As mentioned in the "Training" section of chapter 2, there were many training sessions that SIMI staff led as part of the MUS project. For Krishnapur Tole, SIMI staff led training sessions including: water tank safety; management of water; pipe assembling and maintenance; water distribution; vegetable production practices such as crop timing, seedbed preparation, and postharvest handling; plastic house construction; and pesticide safety. Training targeted for women focused on production cycles, postharvest handling, and agro-processing techniques, and developing sustainable rural institutions.

**Figure 5.6 Vegetable collection center**

Photograph by Ryan Yoder.

## MARKETING

Since the WUC had started out as a farmers' production group organized by SAC several years back, they had already worked together for some time on marketing. SIMI helped the Krishnapur members build on this experience by establishing a marketing connection between Krishnapur and other production groups in Surkhet as well as production groups in three other districts—Jarbuta, Sradkhani, and Ratu. A formal coalition marketing committee and collection center were set up in Jarbuta (Figure 5.6) in 2005. At high-production times, vegetables are collected at the center every 15 days and sold in the market in Birendranagar. At low-production times, the farmers have the option of taking their produce to a weekly bazaar in Birendranagar that was started in December 2006 or selling it to traders who come to the village on the way to the bazaar.

# OUTCOMES

Just as in Chhatiwan and Senapuk, with the introduction of vegetable growing, vegetable sales have become another means of obtaining cash income for Krishnapur's farmers. While cereal production before and after MUS implementation was the same for Krishnapur Tole farmers, the types of vegetables grown, the area under cultivation, and even the yield of traditional vegetables all expanded (see Table 5.1 for details of the change).

Nearly 90 percent of the households in Krishnapur Tole now grow vegetables all year round, increasing their vegetable production area per house-

**Table 5.1: Production volume and value of different crops pre- and post-project for nine Krishnapur households over one season**

| | Vegetable | Pre-Project Production (kg) | Post-Project Production (kg) | Increase in Production (kg) | Average Sale Price (NPR/kg) | Gross Sales of Increased Production (NPR) | Gross Sales of Increased Production ($) |
|---|---|---|---|---|---|---|---|
| New crops | Cauliflower | 0 | 472 | 472 | 17.25 | 8,142.00 | 116.31 |
| | Bitter gourd | 0 | 248 | 248 | 23.78 | 5,897.44 | 84.25 |
| | Cabbage | 0 | 220 | 220 | 7.14 | 1,570.80 | 22.44 |
| | Tomato | 0 | 137 | 137 | 12.00 | 1,644.00 | 23.49 |
| | Brinjal (eggplant) | 0 | 65 | 65 | 15.00 | 975.00 | 13.93 |
| | Pole bean | 0 | 41 | 41 | 24.26 | 994.66 | 14.21 |
| | Pumpkin | 0 | 15 | 15 | 0.00 | 0.00 | 0.00 |
| | Cucumber | 0 | 14 | 14 | 0.00 | 0.00 | 0.00 |
| Traditional crops | Radish | 0 | 5 | 5 | 0.00 | 0.00 | 0.00 |
| | Onion | 150 | 440 | 290 | 11.35 | 3,291.50 | 47.02 |
| | Chili | 40 | 147 | 107 | 21.06 | 2,253.42 | 32.19 |
| | Garlic | 101 | 119 | 18 | 21.81 | 392.58 | 5.61 |
| | Potato | 95 | 110 | 15 | 17.42 | 261.30 | 3.73 |
| Total | | 386 | 2,033 | 1,647 | | 25,422.70 | 363.18 |
| Average per household | | 43 | 226 | 183 | | 2,824.74 | 40.35 |

Source: This table is based on recall data during interviews with nine of the sixteen households. Sales where produce was weighed and paid for are likely quite accurate, but home consumption and sharing of produce with family/neighbors was difficult for individuals to remember.

hold from 100 m² before the project to 260 m² afterward. Through SIMI trainings, farmers have shifted to using all hybrid seed varieties except for the more traditional crops of potato, onion, and garlic. However, improvements in their cultivation have also caused yields of traditional crops to increase. Newly introduced vegetables grown from greatest to least quantity are cauliflower, bitter gourd, cabbage, tomato, *brinjal* (eggplant), pole bean, pumpkin, cucumber, and radish. Considering only the new vegetables cultivated in the first post-project season (the rainy season), the production of vegetables increased by 135 kg/household. Table 5.1 shows the change in vegetable production before and after MUS project implementation for one crop season.

According to the production of the nine interviewed farmers, the average income per household from vegetable sales in only one season post-project was NPR 2,825 ($40.35). For two of the three households who receive 100 percent of their income from agriculture, vegetable production jumped from zero to 13 percent and 25 percent of their income. For the remaining seven households, income from vegetable sales ranged from 1 to 9 percent of their total income. Unfortunately, the monsoon season the first year after the MUS system was completed was unusually severe, and the farmers were unable to save a large portion of a number of their crops including cauliflower, cabbage, and tomatoes. Other crops suffered as well, leading to lower-than-anticipated yields for all crops. Exacerbating this crop damage, poultry roaming in the cluster became a source of damage for the vegetables. Due to these problems, two of the nine households had a deficit budget that year. It is anticipated that were it not for the intense rains, yields and income would have been much higher.

The increase in vegetable production positively impacted health. Consumption of fresh vegetables increased along with food security. In fact, households consumed a large percentage of their vegetable produce with poor, middle-income, and wealthy households consuming at 47%, 38%, and 33% respectively. As might be expected, poorer households consumed a higher percentage of their produce. This means that households saved on average NPR 932–NPR 1,328 ($13–$19) from consuming their own vegetables. As mentioned above, four of the nine interviewed households were food insecure for four to five months per year. These households indicated that they have gained an additional three months of food sufficiency from consumption and sales of their vegetables, greatly reducing their food insecurity. Wealthier households have the resources to purchase vegetables in the market to augment their production and enable them to enjoy a greater variety of produce consumption.

Additional health benefits came from the increased domestic water available at the household for sanitation. Prior to MUS implementation, seven households in the Krishnapur Tole cluster had latrines, but after MUS implementation, seven more households built latrines with support from a local organization. They were able to build the latrines because of the additional water they had received through MUS. In the next few years, a municipal drinking water project funded by the ADB will be providing all VDCs from the source to Birendranagar with drinking water.[7] Karre Khola will be among the communities served by this project. The benefits of this additional domestic water as the population grows will be invaluable.

Regrettably, the production of vegetables has led to the cessation of poultry raising in the cluster. Prior to the MUS project, Krishnapur farmers raised some poultry, but because they caused significant vegetable damage, the households got rid of them. This has resulted in a loss of income as well as nutrition from meat and egg consumption. Unlike poultry, goats and cattle are kept in the house or in a goat shed to keep them away from the vegetables.

As in the other cases, another benefit from MUS installation is the reduction of time spent collecting and carrying water in the dry season for domestic needs. The previous collection time of one hour twice per day for the 60-day dry season period adds up to 120 labor hours saved, equal to three 40-hour workweeks within a two-month period. At the local female labor rate, this equates to NPR 750 ($11) per household.

## CONCLUSIONS AND LESSONS

Although there was economic benefit to Krishnapur Tole cluster from the MUS system, it was less pronounced than expected. This was largely due to damages to the vegetable crops from heavy rains and poultry. It would be an added cost for the Krishnapur farmers, but SIMI could assist them with the option of plastic houses under which to grow their vegetable crops to protect them from excessive rains. And the termination of poultry raising was an unnecessary result of the project and could have negative consequences on their overall nutrition and income. For future MUS systems, SIMI should include information about the potential impact of animals on vegetable production and ways to mitigate crop damage.

The unforeseen crop-damage setback reduced the potential positive impact of the MUS system for that first year, but it does highlight the limited stretch of any one project within the broader context of a community's water resource development. This case exemplifies the ability of a very-water-scarce community to integrate their own water resources management as water needs have changed over the nearly 100 years of agricultural development in the Karre Khola valley. The MUS project activities are part of a long series of actions that the Krishnapur Tole cluster has mobilized from internal and external resources. And since most of these activities have been developed for a single purpose, integration of water resource management has been almost entirely up to the villagers.

The first water-control development was for paddy production through canals, but as settlements emerged in the past 40 to 50 years, domestic and livestock water needs became dominant, and the cluster requested the Rural Water Supply Program build them a drinking water system. As irrigation supply from the canals became constrained, they requested support from the DoI to line the canals, increasing the water they obtained from them. Later, they worked with SIMI to design a scheme to use the extra water from the lined canals and built homestead storage for multiple water uses. And when they found that the water available through the canal was not quite enough for their needs, they extended the MUS system to add water from another spring in the Bhandari Khola. They continue to plan and lobby for development of additional sources of water to meet their multiple needs, particularly in the dry season. The future ADB project will add yet another layer to this series of water resource projects.

Another interesting lesson from Krishnapur is that when water is scarce, greater control over the resource is necessary. In order to increase their control over their water use, farmers first opted for water storage at the group level and then for greater flexibility added homestead storage. The use of homestead storage combined with the cluster storage tank is a different configuration than seen in all other MUS systems built in Nepal. When water is delivered to taps from a single tank, although everyone is entitled to the same amount of water, actual usage may not end up being equitable. In a water-scarce situation like Krishnapur, the use of on-site storage was an innovative way to cut down on community conflict and ensure equitable distribution. It also allowed individual households much greater flexibility of use, choosing how much to utilize for each purpose and when to irrigate.

Residents of Krishnapur Tole cluster definitely benefit from being part of the larger canal irrigation system of Karre Khola. Not only are they entitled to canal water through their operation and maintenance contribution, but they also had a history of water resource management that has enabled them to be more adept at finding available schemes to meet their water needs. It has also given them the experience of working together as a community to advocate for their needs to government bodies such as the DoI and the Rural Water Supply Program.

As in Senapuk, women provided more of the labor for construction but were less included in the construction committee, which points to the need for greater inclusion of women in decision-making activities. Positively, when the construction committee transitioned into the WUC once the system was built, a greater number of women were voted onto the committee than before.

CHAPTER **6**

# COMMUNITY-LEVEL LESSONS

Photograph by Monique Mikhail.

The organization of this chapter is based on the 14 principles outlined in the CP-MUS Action Research Framework that are required at the community, intermediate, and national levels to implement and scale up multiple use water systems. (See Van Koppen et al. 2006 for more information on the MUS principles.) Information from IDE/Winrock MUS projects in Nepal, other than the three case studies, is used to augment the lessons from the three case studies in chapters 3–5. The information is based largely on personal and group interviews that occurred during February–May, 2007, group meetings, and questionnaires.

Interviews with IDE staff at the national level included the following:

- Deputy Team Leader, SIMI
- previous head of Engineering, IDE-Nepal; now Team Leader, Technical Assistance Microirrigation Project, Nonconventional Irrigation Technology Project of the Department of Irrigation
- SIMI Engineer

Interviews at the local level included:

- group interviews with communities in Kaski, Syangja, and Lalitpur districts; personal interviews with a few leader farmers and local staff in these districts
- individual interview with the Social Mobilizer for BDS-MaPS project in Lalitpur District
- individual interview with the Social Mobilizer for SIMI project in Palpa District
- focus-group meeting with Social Mobilizer/Community Mobilizer staff during the annual area-level SIMI staff meeting (March 22, 2007)
- focus-group meeting with agricultural technicians, irrigation technicians, agricultural-marketing supervisors, and district managers during the annual area-level SIMI staff meeting (March 21, 2007)

At the focus-group meetings during the annual area-level SIMI staff meeting in Tansen, a questionnaire about the process was handed out and answers collected. It focused on SIMI staff experience with the process, views about it, and suggestions for improvement.

Interviews with partner organizations included:

- district partners—LISP-Helvetas, World Vision, District Agriculture Development Office
- partner NGOs—SAPPROS and CEAPRED
- local implementing NGO in Kaski—SORUP Nepal

Field visits by IDE international staff included:

- Patnari and Odare villages in Kaski District
- Lele and Salyan villages in Lalitpur District
- Rangethati village in Syangja District
- Maredanda village in Palpa District

Information from SIMI staff experience in the following communities was also used:

- Maseri Tole in Birendranagar municipality of Surkhet District
- Bame Khola village in Lati Koili VDC of Surkhet District
- Kavre village in Lele VDC of Lalitpur District
- Bhirmuni Jodhane village in Dhikur Pokhari VDC in Kaski District
- Katuja village in Pelakot VDC of Syangja District

## LIVELIHOODS-BASED SERVICES

### COMMUNITY UNDERSTANDING

What became clear through all of the MUS projects in Nepal was that the concept of multiple-use services is not new to the hill communities. They automatically think of integrating multiple uses of water resources, ensuring that domestic needs take first priority. The Nepal cases illustrate that communities are far ahead of "development" and government agencies in planning and implementing water resource development for multiple use and are very adept at using their own resources and devices as well as combining single-purpose development "projects" to meet their needs.

The Krishnapur (water-scarce) example in Nepal (chapter 5) perhaps best illustrates this. As part of a larger stream-diversion, farmer-managed irrigation scheme, the cluster advocated for the DoI to line their canal to increase water availability. But instead of just using the increased water for their khet land, they worked with SIMI to create greater control over the water with a community storage tank and offtakes for microirrigation of their bari land. When they realized that by adding homestead storage they could create an "all but drinking water " MUS, they shouldered the extra cost for the flexibility it would provide them. And when the water remained insufficient in this MUS system during the dry season, they encouraged SIMI to help them tap a small nearby spring and add that additional water to the storage tank. Furthermore, a few of the households modified the system to also include drinking water. Two of the 16 households opted not to connect their homestead storage to the MUS "all but drinking" water supply and instead filled the storage from the preexisting Mul Pani drinking water system. These households use the MUS water only for irrigation by filling their drip-system header tanks by hose directly from the offtake. They then supplement, when necessary, from their homestead storage containing water from the Mul Pani drinking water system. This mobilization of various resources and “add ons” to existing systems was an effective way to make the most of their scarce supply.

Something similar occurred in Chhatiwan (chapter 3), albeit on a smaller scale. The community originally organized around irrigation access but recognized their need for increased water for domestic use as well. Before working with SIMI, the farmers’ group negotiated with neighboring communities to use some water from the regional traditional source structure and then lobbied their local VDC council to provide them with a half-inch pipe from the source to the cluster. When SIMI MUS activities began, they incorporated this pipe into their MUS system.

Likewise, in Senapuk (chapter 4), the households had a previously built domestic water system that was insufficient for even their domestic needs, so they worked with SIMI to supplement the system with a spring from a stream they had previously used to irrigate their khet land. The new MUS system incorporated the old domestic water system into its design and now provides water for both domestic use and irrigation.

Furthermore, in a MUS project in Lalitpur District, the community had already obtained partial funding for a productive-use system from the local DADO as well as the DoI. But once they learned of SIMI’s MUS activities, they requested help in modifying the project to include domestic uses.

Perhaps most important, MUS systems were able to achieve more buy-in at the community level, including active participation and contribution of both men and women because the system was explicitly providing a service to both the domestic and productive realms of the household. Although single-use systems benefit all members of the household, in Nepal the productive sector is generally considered to be the male realm while the domestic sector is generally considered to be the female realm. While the lines are much less clear in reality and both men and women share in the productive/domestic responsibilities and benefits, single-use systems concentrate benefits on one realm or the other whereas MUS systems equally benefit both realms.

## EXPANDING PRODUCTIVE USE

Although it is generally true that farmers who have more of a financial buffer will take more risks on new innovations, due to the community nature of MUS and the link with microirrigation, most households that have even a small land area are simultaneously taking advantage of the new technologies. Despite this positive uptake of technology, larger farmers still have more land that could be cultivated with vegetables or other crops both on- and off-season. But there are a few limiting factors to this increased production. First, the MUS system can only provide a limited supply of water due to the small spring source(s) they are using. DADO-Palpa suggested the use of plastic ponds for rainwater collection as an added potential component of MUS systems, particularly in cases where the source flow is low. Or the model of MUS in Nepal could be broadened to include the potential feasibility of expanding their water sources by piping water from streams. Second, sometimes factors other than water supply limit expansion of production. For example, in Senapuk there are so many men who working outside of the village that the households are constrained in how much they can cultivate. This is a major consideration for future upscaling of MUS. Unless income gains from productive uses can compete with income from sources outside the community, expansion of the productive component of MUS systems will be limited.

There are other productive-use possibilities in addition to expansion of irrigation and vegetable production that have yet to be explored in MUS systems in Nepal. Due to the way that IDE/SIMI MUS projects have been implemented, many of the other stakeholders in government and other NGOs, and even within the IDE/SIMI team itself, see MUS as basically a dual-function system—irrigation and domestic water.[1] But the idea is broader than this dual function, and the communities themselves are open to other productive uses. Several future possibilities to further raise household income include the following:

- Small-scale food processing to create value-added products. For example, a community cannery could be built to process the fruits and vegetables and sell them for higher prices in the markets.
- Cultivation of tree crops (fruit, nuts). Although the financial pay-back takes longer with these types of crops because it takes multiple years for them to start producing, they can provide greater sustainability and variety of products for sale. They also lend themselves better to small-scale processing options, such as cooking oil and fruit preserves.
- Growth of higher-nutrition fodder to raise a greater number of poultry and livestock. Household wastewater could be utilized to grow the fodder necessary to raise more livestock and poultry for the high-value products they offer.
- Microhydro projects
- Aquaculture

These suggestions were discussed during the community group interview in Senapuk. They recognized that microhydro projects were not a cost-effective option for them, given their water source, but they were definitely interested in fish ponds, fruit crops and their potential processing, and growth of fodder to sustain more livestock. They were less interested in tree crops because they felt that they would produce too much shade and reduce production of their vegetables.

## HURDLES TO GREATER INCOME INCREASES

Increases in income from vegetable sales have been an important financial boost for households with MUS. The average household income from vegetable production over two seasons (after-consumption sales minus costs) was$330 in Chhatiwan and $199 in Senapuk. For Krishnapur, the average income increase for one season was $40.35. Even if this estimate is doubled to estimate what two seasons would produce, the income is much lower than the other two cases. There were several reasons for this result. The systems in Chhatiwan and Senapuk were built a year earlier than in Krishnapur. In IDE's experience, income obtained with vegetable production using microirrigation increases each year for the first four years as farmers become more adept at vegetable production with microirrigation, as the marketing committees improve their skills, and as the whole value chain strengthens. More specific problems in Krishnapur included heavy monsoon rains and effects of poultry raising that led to significant crop damage. Additionally, surveys were done after only one cultivation season (the rainy season), so increased gains from off-season production had yet to be seen by Krishnapur farmers. Chhatiwan also faced environmental factors like hailstones and mice chewing drip lines, albeit to a lesser extent. In order to realize the highest income gains possible through MUS projects, SIMI and other implementing agencies should consider the major potential problems for farmers in obtaining high yields and seek to mitigate these problems prior to vegetable production. SIMI has begun this effort by testing the availability and performance of various hail-net sheds that could protect crops from hailstones.

Despite the hurdles farmers faced, vegetable production for two seasons through MUS averaged 15–27 percent of annual household income in the three detailed cases.[2] While this is a significant amount, particularly for such a recent project, much of their income still comes from pensions, remittances, and other employment (service and religious work). And although the added income is a good buffer, it is not yet significant enough for family members outside the village to return and work in agriculture. However, it is a notable economic opportunity for household members unable to travel outside the community for employment, and it is incredibly important for the poorest households whose vegetable sales comprise a larger portion of their income.

## MARKETING CHALLENGES

Some aspects of marketing posed another hurdle for farmers. There is no set formula for marketing of the produce from the MUS systems. Although collection centers were attempted in all three cases, in Krishnapur the collection center is working well; in Chhatiwan it was completely stopped; and in Senapuk it still exists, but the community was not completely happy with it. One possible reason for this difference is that Chhatiwan and Senapuk were the first two MUS systems built, so SIMI was still in the nascent stage of developing them. Another possible reason is the presence of other marketing options. While Chhatiwan only had the options of selling to the marketing committee or individually selling in the market, Senapuk and Krishnapur had other marketing possibilities besides the marketing committee. Senapuk built a marketing center along the all-weather road and also went to Butwal to sell ghee and could sell vegetables there as well, and Krishnapur had the weekly bazaar in Birendranagar and sold to traders who came into the village on their way to the bazaar. Perhaps having multiple options allowed farmers to feel that they could participate in the marketing committee while still maintaining some level of control over marketing their produce. Some interviewed households did mention a preference for selling their produce in the market themselves because they could then do their purchasing at the same time. And Senapuk women felt greater independence if they sold independently.

Chhatiwan members also indicated that the lack of commodity price information was the reason they felt they were not receiving a fair price. Although the members of Senapuk did not specifically mention commodity price information as the reason, they, too, said they felt the prices they were receiving were lower than expected. This feeling of being "cheated" on price is a critical one for prolonged involvement in vegetable production and marketing. SIMI has already taken some corrective measures to mitigate this problem by ensuring that price information is broadcast over FM radio in the areas where it works. SIMI is also helping to set up district apex marketing committees to help the smaller district marketing committees access markets beyond their districts.

While the current local-market possibilities for hill communities in Nepal are high, they may not always remain so. At present Nepal imports significant quantities of vegetables from India, and Nepali producers could replace these imports. However, massive upscaling of MUS activities could create a marketing problem, especially in smaller communities, if saturation of vegetable markets causes prices to drop, resulting in a decreased financial benefit of MUS. Diversification of crops and water-related enterprises should be explored for effective MUS upscaling.

## CHANGES IN SOCIOECONOMIC POWER DISPARITY

While the direct benefits of increased income are notable, the indirect benefits are also striking. In Senapuk, MUS is actually changing the power dynamic between rich and poor. Because of their improved financial situation, poorer households are no longer obligated to take as frequent or large loans from their wealthy counterparts in the village and are therefore less beholden to them. They can also now borrow from the community revolving fund. In Senapuk as well as other villages with MUS the wealthy are actually not cultivating vegetables but are purchasing vegetables from the poor in the village. This creates a local market for the poor.

On the downside, SIMI staff mentioned that in one MUS project the richest people are demanding more water for bathing and clothes washing because they feel entitled to a larger portion of water than the poorer households. Despite the fact that all households contributed the same amount in labor, cash, and fees to the MUS system, because the richer people have higher positions in the community, their requests for extra bathing water are "accepted" by the rest. This type of class-based prioritization is common in the hills. However, according to SIMI field staff, out of all the communities that have built MUS systems, only one still displays this behavior.

## HEALTH IMPACTS

When interviewing the households of communities with MUS systems, it became evident that the health improvements they felt were as equally important as the direct and indirect financial benefits. The additional domestic water has been critical for many of the households, and improved hygiene ranked high among benefits of the system. Communities also reported that increased vegetable consumption has improved their feeling of well-being.

As SIMI progressed through MUS implementation, SIMI staff received feedback that a stronger sanitation component was required. According to SIMI staff, increase in availability of domestic water coupled with SIMI's encouragement of sanitation has also boosted the construction of latrines in MUS villages as well as the overall use of water for sanitation and hygiene. This in turn increases community members' pride in their village because it is cleaner. But even though some individual households took it upon themselves to construct their own toilets after project implementation, there was no comprehensive plan for sanitation within the MUS project. Therefore, BDS-MaPS hosted a one-day orientation on sanitation in December 2006 which was led by both SIMI engineers and an engineer from the Nonconventional Irrigation Technology Project (NITP) of the Department of Irrigation. Additionally, at the beginning of 2007 an all-MUS demonstration of Ecosan toilets was initiated. In each SIMI MUS site, staff request that one household volunteer to purchase and install an Ecosan toilet with SIMI's assistance in order to demonstrate its use and applicability to the community. This has begun to raise awareness about sanitation and the use of composted human waste as fertilizer for crops. If incorporated into these communities further, it could minimize water use for sanitation, increase agricultural yields, and minimize disease transfer through open defecation.

## SCHOOL-ENROLLMENT INCREASE

Field staff and communities interviewed all reported that due to health improvements for children, one major benefit of MUS systems has been increased school enrollment. In addition, children, especially young girls, no longer need to spend hours carrying water, so they have more time for school.

In one Kaski MUS community called Patnari, most of the people are landless and previously could not afford to send their children to school. With vegetable production and sales, they can now afford school fees and materials, so enrollment has increased. In Lele village of Lalitpur District, all 28 households worked in the stone mines, and the children of 15 of the households worked in the mines with their parents for extra income. Due to the increased income from MUS, ten households have completely shifted to vegetable production and stopped working the mines, and although the remaining 18 families still work in the mines, all 28 families can now afford to send their children to school regularly.

## INCREASED CAPACITY TO ACCESS AVAILABLE RESOURCES

The construction of MUS systems is creating intercommunity connection and facilitating interaction with other NGOs and government agencies. At the beginning of a MUS project, SIMI will facilitate a farmer-to-farmer exchange visit with another village that has implemented a MUS system so that the community can see firsthand what the system looks like and hear stories of its impact from other farmers like themselves. Often these visits are the most compelling support for working toward a MUS system in their own village.

But even without these farmer visits, neighboring villages regularly share information. It is this information sharing that is leading more and more communities to search for ways to implement MUS in their own villages. This is a powerful mechanism for dissemination of information about MUS and the most compelling encouragement for upscaling. According to IDE/SIMI field staff, partner NGOs, local-government agency staff, and MUS villages that have been interviewed, villages surrounding those with MUS schemes are all requesting MUS systems from local government officials, local NGOs, national NGOs, and IDE/SIMI. Additional facilitation of farmer-to-farmer communication is needed to further expand knowledge of and interest in MUS. For example, monthly farmer forums in Kaski bring together local government officials, NGOs, and farmers to discuss local agricultural problems; this could be a great way to disseminate information about MUS.

One of the major benefits of MUS systems is that it allows for both community and individual action for improved living conditions. The Social Mobilizer from Lele village in Lalitpur indicated in her interview that she realized that the process of implementing MUS had strengthened the cohesiveness of the community. Through the development of an active WUC, extensive training activities, and regular interaction with government officials, NGOs (local, national, and international), and outside visitors, the community learns the most valuable tool of all—how to work together to advocate on their own behalf for community-led use of their water resources. Yet within the community parameters, there is also flexibility to take initiative on a household basis to use more of their land for agriculture, thereby increasing their livelihood security, food security, and, for women specifically, increased financial autonomy.

However, there could be greater encouragement of women for vegetable production with MUS. One IDE/Winrock program in Nepal, BDS-MaPS PRIME focuses only on women and disadvantaged groups and could lend lessons to the other programs through which MUS is implemented. Social mobilizers play a key role in motivation of women for vegetable cultivation. Gender-awareness training for the community in addition to trainings on vegetable production and marketing geared specifically for women could help raise support for women in vegetable production. And building the capacity of women to access resources, such as linkages with input and output traders, could help increase women's empowerment.

## IMPROVED COMMUNITY PROFILE

All of the MUS communities have also found that MUS raises their pride in their villages. Since MUS communities have become model communities for other hill villages to visit, the scheme raises their esteem with neighboring communities. MUS communities also have frequent outside visitors from government agencies and NGOs (local, national, and international). Due to this showcasing, communities feel they have something to be proud of, which not only boosts their self-image, but encourages upkeep of the system because they know others are aware of their activities.

## IMPORTANCE OF CHAMPIONS

The importance of a champion for the projects cannot be understated. Dal Bahadur Disa in Chhatiwan is a perfect example. Often the leader farmers become the leadership of the WUC. For example, in Lele there was one farmer (Chandra Bahadur Sundas) who realized that food scarcity could become a real issue for his community if they did not take some initiative. Many in the community were forced to be day laborers in the stone industry in addition to farming to ensure enough food for their families. But day-labor job availability depends on the contractor, decreasing villagers' job security and food security. Due to MUS they have shifted to vegetable production, and many no longer work as day laborers. Chandra Bahadur Sundas became the chair of the WUC. Like Dal Bahadur Disa and Chandra Bahadur Sundas, in many MUS projects the champion was a leader farmer but also sometimes the VDC Secretary or the DADO of the district.

# SUSTAINABLE WATER USE

## INCREMENTALLY IMPROVING KNOWLEDGE/RAISING AWARENESS

### Training

In all MUS projects, staff led numerous training sessions including water tank safety, management of water, pipe assembling and maintenance, and water distribution. Training programs lasted anywhere from two hours to seven days, depending on the subject matter. (A full list of trainings is given in chapter 2.) Trainee selection was done through user-group discussions, with emphasis on training key farmers who then became trainers of others in the group. Although some class-based theoretical learning was conducted, most training focused on practical demonstrations.

### Water Quality

Where water quality is definitely an issue, as in Krishnapur, the community has demonstrated their ability to keep sources with different water qualities separated. Household-level storage is key to making this separation possible. Therefore, improving low-cost options for on-site storage is a priority.

Yet, despite the water safety education provided as part of the MUS projects, a lack of prioritization for source protection is still a problem in some communities. Most of the Nepal MUS projects built covered tanks right at the intake from the spring to protect the source. Since this is standard practice for drinking water systems in Nepal, MUS projects have taken drinking water standards as a guide However, in Senapuk the intake remains uncovered despite pressure from SIMI to complete the cover. Perhaps the community does not perceive that the cost of the cover is worth the source protection it will provide. Or maybe they feel that the water is clean enough regardless. Similarly, in the Lele MUS system in Lalitpur District,[3] children break into the intake to play and remove the rocks that are intended to block soil and leaves from entering the system. While the community has chided them for this behavior, they have not placed a fence or other protective barrier around the source. And although the WUC in Lele had planned to at least include a filter at the intake, they have not yet put this in place. Although new MUS systems are being designed with sand filtration at the inlet to increase protection, these examples point to a lack of priority for source protection at the community level.

And unlike the single-tank, one-line distribution systems, those with a two-tank, two-line system must be careful about the use of the water from the productive-use tank. The larger ferro-cement lined tanks do not have a cement cover, but simply a corrugated iron sheet. Therefore, although the water in the productive tank is simply overflow from the domestic tank, once it is in the tank, it is not as protected. Even though water in the productive-use tank is not meant for domestic use, some families whose houses are closer to their offtake than their hybrid domestic tapstand are using the water from the offtake for domestic purposes. These households should be made aware of the water-quality difference in the two tanks during the trainings provided by SIMI.

Another potential for concern is a lack of testing of the water source quality prior to system construction. It is assumed that spring-water quality is good, and often the source used is the only one available to the community. The springs used have the same water quality as other sources used for domestic water development in the hills of Nepal, and their quality is usually better than the surface water available. And simply having more water available to households for domestic use is known to improve health.

### Water Quantity

MUS systems have been useful to raise awareness of water conservation in hill villages. Even in areas with scarce-to-moderate water supply, domestic taps are often left running even if they have a mechanism to shut them off. Many MUS systems are designed to capture and use this overflow water. Additionally, with the double-tank, two-line distribution design, it is beneficial for the community to shut off their domestic taps when not in use because it increases the amount of domestic water and the overflow collects in the productive-use tank. In Senapuk, the desire to expand the hours of access to water resulted in successfully promoting the closing of community taps immediately after drawing water.

Additionally, the use of microirrigation is a tangible way for people to see how even a small amount of water can be productive. Many of those interviewed, in the villages as well as in partner NGOs and government agencies, mentioned that they were skeptical that such a small amount of water could actually result in plant growth, particularly in the dry season when evapotranspiration rates are high. Yet farmers with microirrigation systems are growing successful crops with much less water. This concept of more efficient water use for crop production is influencing not just the farmers in the villages but individuals working in the DoI and DoA as well, and the promotion of microirrigation technology through government programs is expanding rapidly.

> *"MUS is small and small is beautiful."*
> —Chief of DoA M&E Section

However, despite these positive changes, communities are largely using the microirrigation systems only in the dry season. In the monsoon and postmonsoon seasons they use the microirrigation kits for a set land area but then hand-water with a hose or bucket on a larger area of land. Despite the benefits of microirrigation and the ability to use less water for higher yields on the same land area, farmers still do not perceive that the benefits outweigh the cost of purchasing additional kits for expanded microirrigation. Ultimately, the use of microirrigation makes more sense to them when water is scarce, but conservation is less important during times when there is more water. Perhaps as the populations of these communities grow and competition increases for the water supply, the use of microirrigation in the monsoon and postmonsoon seasons to conserve water will become more prevalent.

## EXPANSION OF WATER SOURCES FOR MUS

In conjunction with the education about efficiency of water use and the positive attributes of microirrigation, the construction of MUS has led to the realization that there are many small water sources in the hills of Nepal that are critical for future water resource development. Prior to MUS, stakeholders generally argued that most of the economically feasible water sources were already exploited in Nepal and that there was little likelihood of finding additional sources in the hills. Yet there are tens of thousands of small sources (springs and streams) that have not yet been utilized or are underutilized. And, through MUS, IDE/SIMI is demonstrating the possibilities of use for these small sources.

However, the challenges to using them must be overcome. While stream flow is largely dependent on snow melt from the Himalayas, spring discharge is dependent on the monsoon rains. Therefore, flow variability exists not only from one spring to the next, but also between seasons for the same spring. Some springs stop altogether in the dry season. And due to the sheer volume of these small sources, they have not all been mapped or measured, nor is there a central registry where use claims on them are catalogued. Moreover, the opportunities are not uniform throughout Nepal. Some locations have abundant water, whereas others have scarcity for part of the year like in Krishnapur. It is only by going to a community site and talking to the local residents that detailed information can be determined on the location of water sources, who owns the legal or customary rights to their use, and which (if any) government office rights owners have accessed to support their claims. Most important, tapping these smaller sources will require negotiation with communities or individuals over the right to use the sources. And if MUS are to be scaled up, the government will need to streamline its formal rights-registration process.

Despite these hurdles, the potential for expansion of small water sources for MUS is substantial. Those that have yet to be tapped can be used to build new MUS systems. And even when using rural domestic water systems that have already been built, local people can easily identify which springs are not yet fully utilized, thus allowing some of those water sources to be captured for productive use.

As a note of caution, while the use of these springs has great potential, if all of these small sources are fully captured, it will decrease the flow levels in streams and rivers, some of which are essential to the populations in the Terai and other neighboring countries. The importance of ensuring adequate flow levels to uphold ecosystem health as well as provide water for downstream communities must not be overlooked. The danger is an uncoordinated effort to build MUS by many NGOs and government agencies with no consideration of how the water resources interact with one another. It is essential that if MUS is to be scaled up, the government must take the critical role of coordinating the construction of these schemes and safeguarding downstream water flows.

Although water-system design for multiple uses, utilizing canal water or other surface water, has largely not been planned in the past, surface sources could, in many cases, be better utilized for every purpose except drinking water. Even though most MUS systems constructed in Nepal to date have used spring water as their source, other sources hold potential as well. Krishnapur is an exception and can be a model for expanding MUS sourcing to include canals and other surface water. If springs are not available nearby, surface-water sources can be utilized for all productive and nondrinking domestic purposes. And if treated, such water could be used for drinking as well. In certain areas, rainwater harvesting is also a promising option to augment small-spring or surface-water sources, particularly as a complementary source to an existing spring that may be at low flow. Rainwater harvesting can be a collective system or done on an individual basis, depending on the community.

It is also not necessary for all schemes to be gravity-fed pipe systems. In one Palpa scheme, half of the community is above the water source and could be served by pumping water up to them. However, pumping and extra storage both add significantly to system costs. These additional source options should be included in the menu of options considered by communities in conjunction with project teams. Various combinations of sourcing and storage considerations based on usage needs, source availability, and financial resources can be created.

## WATER-USE NEGOTIATIONS

As more sources are sought for additional MUS schemes in Nepal, negotiations for rights to use the water will become even more important. Without the legal rights to use the water, a host of complications arise. Nearby communities can claim ownership through customary use and disrupt the use of the source. Or as populations grow, the domestic-use priority rule could force communities with MUS systems to give up their productive-use allocation for the domestic purpose of neighboring communities. This potential for conflict over source allocation is precisely why SIMI requires the community WUC to undergo negotiations for legal access to water-use rights, even though those negotiations are often long, involved, and difficult.

Water rights and related management issues and the way the implementing organization and community deal with them are critically important in the success of MUS projects. While examples occurred in a small minority of projects, conflicts have actually stopped MUS construction and caused problems for communities after project completion. In the Maseri Tole MUS scheme in Birendra Nagar municipality of Surkhet District there are two interrelated problems. The pipes are getting clogged with lime, so they must be cleaned out every 15 days. This requires the community to keep the pipes above ground instead of burying them, even in the forest where other communities collect firewood and grass for cattle. People from these other communities have been cutting the mainline pipe that delivers water through the MUS scheme to the Maseri Tole. It is unclear what their motivation is, and it could potentially just be mischief-making. But according to SIMI staff, they may also dislike the Maseri Tole because they are a Dalit[4] community, and the mischief-makers may believe that the community does not deserve water. Or they may just be jealous that another community is receiving assistance. In order to solve the pipe-cutting problem, the Maseri Tole community decided to increase supervision around the pipeline and pay an operator to walk from the source to the tank several times per day. This has stopped the pipe cutting.

As this management issue shows, where common property is channeled to one community, other communities have no incentive to respect the user. Solutions require either policing as is now practiced or finding a way to bring all stakeholders to the common property use on board. The second option is both complex and time consuming and is not something SIMI is currently well positioned to undertake. However, in situations such as this, the right partner NGO could help SIMI and MUS communities resolve these management issues.

Another example is Kavre village in Lele VDC of Lalitpur District where project progress is indefinitely stopped due to a conflict between the community that MUS was being built for and the upstream community that has rights to the water source. The original agreement was that the neighboring community would receive two drinking water taps for allowing the Kavre village to use some of the source water for MUS. However, after the detailed engineering survey, they increased their demand to six drinking water taps and coverage of 47 households instead of the original 33. The two communities are now unable to come to an agreement, in part due to caste differences. The upstream users are Dalit and other lower castes, whereas the downstream community is a mix of upper and lower castes. IDE attempted to help them reach an agreement by holding a group meeting between both communities, but the upstream group refused to participate. The project cannot continue unless an agreement is reached. And since most of the funding is coming from the NITP of the DoI for the project, if it is not constructed within this fiscal year, the money will have to be allocated to another community.

Sometimes communities simply will not come to an agreement, and there is nothing SIMI can do to prevent that. Much depends on the skill of local leaders and facilitators. The first example indicates that IDE's follow-up system with communities that already have MUS projects may not be strong enough and that perhaps the WUC's capacity to deal with these sorts of issues is not being fully developed. Both the lime problem and the pipe-cutting issue did not come to light until an impromptu visit was made to the community by national-level IDE staff. Well-designed follow-up has two functions: to ensure that problems are dealt with and that feedback into the process helps avoid similar problems in the future. Without proper follow-up built into the program, these cannot occur and conflicts like the one in Maseri Tole are likely to spring up. However, this is again an issue of resources—the implementing organization(s) must incorporate follow-up into the process so that time and money are allocated for it.

The second example shows the necessity of coming to an agreement with other source users prior to project construction. Another community that dealt with conflict during construction is Bhirmuni Jodhane village in Dhikur Pokhari VDC in Kaski District. The problem in Bhirmuni Jodhane occurred between two clusters within the same community, one upper caste and one Dalit. The MUS system was planned and constructed for the whole community, but the upper-caste households hesitated to use water from the same pipeline as the Dalit community because cultural norms dictate that water Dalits use is "polluted." In Nepali culture, when an upper caste is using a source, Dalits are not allowed to use the same source. During planning, the Dalit community said that they would not contribute labor or materials to the scheme if they were not allowed to use the same source as the upper-caste cluster. The upper-caste cluster agreed to the use of the same source but not the same pipeline, so the Dalit cluster started rioting in protest.

SIMI facilitated a community group discussion where all castes were required to sit together to come to an agreement or construction would halt. The VDC Secretary also participated in the negotiation meeting to motivate both sides to come to an agreement. The two sides finally agreed to have two separate outlets from the tank, one for each cluster, with an increase in labor contribution for both clusters. They only excavated one trench and laid the two pipes in it from the tank but built separate water tapstands for each cluster.

Another conflict that was resolved during the process was Katuja village scheme in Pelakot VDC of Syangja District. The problem occurred during the arrangement of an agreement for use of the source because it was owned by one landowner outside the community who was not part of the MUS scheme but had longstanding customary rights to the source for irrigating his khet because the source was on his land. At the beginning he was unwilling to share the water, so the community, the VDC Secretary, and SIMI all met with him repeatedly for a week to come to a resolution. The community offered to provide him with a drinking water tap next to his home. Although he had already been using the source for drinking, it was not yet piped to his house.

He agreed to this arrangement, and a party was organized in celebration. Conflict has not arisen since project completion.

Both Bhirmuni Jodhane and Katuja show the power of involving the VDC Secretary in conflict mitigation. The Secretary's presence was important because the communities are aware of the power of the Secretary's position. Although the Secretary did not explicitly mention it in the meetings, he can pull funding from the project if it looks like problems will not reach resolution, and communities do not want to lose their projects. The Secretary's presence also creates a more binding agreement than if it were brokered only in the presence of the two communities.

In Senapuk (chapter 4), it also took a great deal of effort for the community to negotiate use of the water source from the previous owner. They ultimately agreed to give ten bags of cement to improve the diversion and canal for the existing irrigation scheme to the owner's fields and restrict the size of the pipe at the intake of their MUS scheme. And in Bame Khola MUS scheme in Lati Koili VDC of Surkhet District there were conflicts between two clusters sharing the source within the village. The first cluster that had previously been using the source had used a temporary mud canal to divert it. The cluster was originally uninterested in sharing the water because they thought the source had less water than it actually did due to the seepage loss through the mud canal. The second cluster worked around this by requesting a UK Department for International Development funded project to make a permanent canal so they could utilize the seepage water. After this, an agreement was reached between the two clusters.

The importance of resolving these problems as part of the initial planning phase of the project cannot be understated. And although in practice SIMI requires the community to have written proof of their legal right to use the source prior to scheme construction, perhaps an even more rigorous requirement is necessary. Perhaps probing communities as to other upstream or downstream users, their castes, political or cultural tensions that exist, water uses already existing, etc. needs to be undertaken as part of the MUS process in order to mitigate potential rights problems before they arise.

## APPROPRIATE TECHNOLOGY

### USE OF EXISTING TECHNOLOGY COMPONENTS

When working with new communities on MUS projects, SIMI first encourages communities to utilize existing infrastructure and then build upon it. Many domestic systems (some in varying states of disrepair) and farmer-managed irrigation systems exist in the hills, but overflow from these systems often that can be captured and utilized more efficiently. As can be seen in all three of the case studies, SIMI worked with communities to build the MUS concept into existing infrastructure. In Chhatiwan they used a portion of water from the existing source and incorporated the half-inch pipe that the community had previously obtained from the VDC into the MUS-system design. In Senapuk, they incorporated the previous drinking water system into the design for the new MUS system. In Krishnapur they utilized water from a branch of the existing farmer-managed and recently lined surface-irrigation system to create their MUS system. Adding on to existing infrastructure helps communities utilize their available resources more efficiently, reduces conflict over water resource capture, and minimizes system cost.

## SITING FACTORS

Siting the locations of the community storage tank(s), hybrid tapstands, and offtakes is one of the most challenging tasks of the WUC and SIMI team when designing MUS projects. In fact, when discussing the construction process with the SIMI district teams, it was highlighted as the most contentious issue within the community because all households want to have the tapstand or offtake placed as near to their homes as possible. Resolving the problem becomes a balancing act between equitable access, convenience of hybrid-tapstand use, the relative location of bari land for each household, cost considerations, community politics, and who is willing to provide land upon which to build the system components.

The SIMI team begins by recommending a design to the community, but ultimately it is the community that must come to agreement on the locations chosen, and it is often the Social Mobilizer/Community Mobilizer[5] who is responsible for mitigating any arguments. The SIMI team first seeks government land for construction of the tanks, but if it is not available, community members are requested to give their land, and sometimes the landowner will negotiate to have an extra tap or storage in exchange for his land. If the household is unwilling to give its land, another site is chosen, and the system design is changed accordingly.

In order to maximize equity and ease of access, the SIMI team attempts to place tapstands such that each house is roughly the same distance from the nearest one. SIMI also seeks to place offtakes close enough to the bari land that it is possible to easily use microirrigation kits. However, as mentioned in chapter 1, households often have bari close to the homestead and more of it further away. While the bari close to the homesteads has been utilized for vegetable production in the MUS systems built to date, for some households the bari is too far away to be covered by MUS, so they cannot use the water for irrigation unless they carry it to the fields, reducing their usage of the MUS system for irrigation. If the further bari is at higher elevation than the MUS storage tank(s), then it is unlikely that the system can be used to irrigate it. However, if the distant bari is at a lower elevation than the tank(s), future MUS projects should consider the cost of system extension to these fragmented landholdings, and households that wish to cultivate their further bari can opt to pay the full cost of that extension.

## RULES OF DISTRIBUTION

### Domestic Use as a Priority

All the cases illustrate the desire to improve access to water resources. Within MUS systems there is a recognized hierarchy of access for the different uses, with domestic water taking priority. In some cases domestic priority is realized through system management (i.e. Chhatiwan), while in other cases (i.e. Senapuk) the priority is hardwired into the system. In Krishnapur there is a separate preexisting domestic water system, but the households manage their own water use priority with on-site storage and equal allocation. In essence, it was seen that with a greater quantity of water available, prioritization of use was not as necessary. For example, in Chhatiwan Tole, the abundance of good-quality water did not necessitate a prioritization of one purpose over the other, whereas in Senapuk the community clearly felt that they needed to safeguard the domestic supply. It is important to provide clear options that are visible to all users to establish the priority of domestic use and equity in access. Most MUS systems in Nepal (modeled after the Senapuk double-tank design) ensure through the system design that domestic water needs are taken care of first, with productive-use water being supplied by overflow from the domestic tank. In all cases, it was the user groups themselves that jointly decided upon allocation, but domestic water always remained a priority. See Yoder et al. 2008 for further discussion on system design for priority-use rules.

### Allocation Flexibility

The combination of domestic and productive-use systems has led to interesting distribution patterns other than priority for domestic use. In single-use systems, rules of distribution vary depending on the system use. For domestic systems, the focus is on equitable supply, whereas in productive systems, distribution is sometimes based on landholding size or the proportion of financial input per household to the project. In MUS projects where the technology links domestic- and productive-distribution systems (i.e. the single-tank, one-line distribution type systems) the “equal share” concept from domestic-only systems supersedes other distribution rules commonly seen in irrigation-only systems. However, in MUS projects where the technology separates the domestic- and productive-distribution systems (i.e. the double-tank, two-line distribution type), the flexibility to apportion water for each purpose according to different rules and norms remains. For example, a community could supply equal distribution of domestic water and provide larger portions of irrigation water for households with more land. While none of the communities with MUS projects have utilized this distribution flexibility thus far, it is believed that this is due to the fact that each household has invested equally. If investments had been unequal, the opportunity to match irrigation distribution to investment proportion would likely have been used. Perhaps this is an argument for subsidization of at least the domestic water portion of MUS projects to ensure that individual households do not capture a disproportionate share of domestic water.

## Scarcity and Equity

While MUS systems displayed an interesting relationship between investment and allocation, they also showed a tie between water quantity and equity in distribution. Where water is more abundant, such as in the Chhatiwan case, domestic and productive water is distributed through the same pipeline. Flow regulation and homestead storage are not necessary because every household has continual access for whatever it needs. Where there is a moderate supply of water, as in Senapuk, allocation becomes important primarily in the dry season. In Senapuk, both domestic and productive water are available continually in the monsoon and postmonsoon seasons. However, in the dry season the WUC asserts greater control over distribution, creating schedules of access from both the domestic and productive tanks and distribution lines. Additionally, in-line flow-regulator technology[6] was incorporated into the system to ensure equal flow despite a difference in elevation of the various hybrid tapstands and offtakes. As the water-scarce case, Krishnapur took things one step further and showed the importance of household-level control over water allotment. To avoid conflict, the farmers worked to ensure that they not only received an equal share, but could store it themselves in homestead tanks to use when and how they chose.

> *"MUS helps to maintain the social harmony."*—DADO-Kaski

SIMI project staff mentioned that in all MUS cases previous water-use conflicts have been mitigated because water has been apportioned formally and clearly through the WUC, and all households know they will have adequate domestic supply throughout the year.

## Adaptive Management

Despite thorough discussion within the WUC and with the SIMI team to come up with the optimal plan for allocation and distribution of each MUS system, the three cases studied in detail showed that none were quite following the planned allocation or distribution of water. First, this shows the difficulty in appropriate planning without the ability to collect sufficient data. Because of distance and time constraints, the selected water supply is generally measured only once and then seasonal variation is estimated by community members by comparing perceived seasonal flows to the measured discharge. There are also large year-to-year variations due to drought or larger-than-average-rainfall years that add to the inaccuracy of this singular flow measurement. Since the discharge available from springs is constantly changing, and data for determining the average and variance is inadequate, SIMI uses conservative estimates so that in most years there is an adequate supply.

Second, it shows that ideally system design should better account for variation and projections of population growth and increased demand. The village community is always changing—be it because of population change due to flux of community members for employment reasons, or because of an uneven desire of various households about whether or not to maximize vegetable production and subsequent change in water need per household.

Third, it indicates that MUS systems better account for the high elasticity of demand for water. Even when domestic systems are designed with an extra percentage built in for productive purpose or population growth (or both), the water is used immediately in the community. If water is abundant, uses are found for what is available. As needs increase over time, households start queuing up for collection, and uses become more restricted (for example, clothes washing and bathing is done at the nearest stream). Systems designed to be domestic with some percentage extra for "additional uses" will likely not account for the future productive needs of the community. By using 45 liters/capita/day and assuming an average family of six, domestic need is 270 liters/household/day whereas vegetable production need is 400–800 liters/household/day.[7] The percentage extra available based on a small (usually 15–20 percent) portion of projected domestic water demand is not enough to provide adequate productive water for very long to all households. On the other hand, MUS system demand is calculated on the projected future productive and domestic demand. With domestic use clearly having priority in MUS systems, it is likely that as domestic demands increase with time, the productive portion will decrease accordingly. However, there is greater likelihood that the productive-use portion will not be removed altogether.

## TECHNOLOGY COMBINATION

MUS projects in Nepal have shown that the use of microirrigation in conjunction with MUS is a potent combination. And it may become even more important as greater domestic demands from population increase take water away from productive supply. SIMI has seen a much higher interest in purchasing microirrigation technologies as part of MUS projects than projects that are solely focused on microirrigation without source development. For example, the chairwoman of one WUC in Palpa District relayed an interesting story about her community. They had originally worked with IDE/SIMI on microirrigation for vegetable production without source development. However, as soon as the SIMI project phased out, they stopped using the microirrigation kits and were instead using the drip header tanks to store water for latrine use. Although the community realized that their problem was lack of water, the microirrigation project had not addressed it, so they reapproached IDE/SIMI, and a MUS system was built. Now that they have an adequate source of water, they are regularly using the microirrigation kits. Due to stories like these, SIMI staff recognized that success of microirrigation is largely dependent on availability of an easily accessible water source. Coupled with higher-volume domestic water, the benefits of the system dramatically increase. Therefore, all current SIMI projects are incorporating the two.

Likewise, microirrigation provides farmers with a useful tool to optimize the productive-use portion of MUS, and farmers have recognized that drip irrigation as an application technology has its greatest advantage under extreme water shortage. Therefore, microirrigation systems were predominantly used during the dry season in communities with MUS systems. MUS water used with drip kits allowed households to grow high-value vegetables during the off-season months when their value was greater.

However, when water is more abundant during the other two seasons or the plot is very small, application by sprinkling can, bucket, and dipper, or a "garden hose" moved from one plant to the next is often easier. A survey conducted by a consultant for SIMI (Shrestha 2007) to assess the reasons why uptake of drip irrigation was less than expected found that 30 percent of the 50 respondents in Syangja District and 24 percent of the 50 respondents in Palpa District did not expand their drip production. Instead, they used manual application because they felt that drip systems were "inconvenient to handle." This inconvenience was explained further as frequent blockage of emitters by particulate matter and lack of ease in shifting the whole drip system to expand the irrigation area. The same percentage of farmers also claimed that due to an abundance of water, there was no need for drip irrigation. However, those interviewed that had MUS systems in their communities had more drip pipes than those who did not have MUS systems. Ultimately, there is no single "best" technology to meet a household's needs in all situations. Instead, a large menu of alternatives must be available from which communities and individual households can pick and choose the best options to meet their specific conditions and needs. This is discussed further in Yoder et al. 2008.

## LOW-COST SYSTEM IMPLICATIONS

### Community Contribution and Ownership

Despite the exact configuration of the various components in MUS systems, SIMI always attempted to find the design with the lowest cost and allow for the greatest input by the community. The SIMI irrigation and agriculture technicians mentioned that prior to MUS the prevailing thought was that water resource development was an expensive venture because of existing construction practices. However, MUS projects implemented by SIMI use local materials and labor, keeping the cost relatively low compared to other water resource development projects. SIMI staff felt that MUS had helped to legitimize the benefits of low-cost technology within Nepal. MUS showed that low-cost systems could be an effective way to manage water resources in the hills, which made the line agencies more receptive to the use of these low-cost technologies and facilitated the working relationship between SIMI and the line agencies.

The low system cost is a huge selling point for all MUS stakeholders. Because the system is kept low-cost and utilizes resources that the community has available to contribute, it allows them to provide around 50 percent of the project cost, which is high compared to other water resource development projects in Nepal. Households and entire communities are more willing to contribute because they gain reliable domestic water and can achieve rapid returns for a low investment in microirrigation. The microirrigation kits are affordable for most farmers who typically recover the cost in just one agricultural season.[8]

And, unlike previous government projects where contractors were hired for construction (sometimes hiring local labor and sometimes not), the community has ownership from the onset of system design and construction. The social and community mobilizers who work in MUS villages stated that due to this ownership, community members take much more care and responsibility for the systems.[9] While the Fund Board and other rural domestic water scheme implementers also require investment from communities, it is generally a lower-percentage investment of the overall cost (around 35 percent) and that is mostly unskilled labor and local materials. Although government implementers of rural domestic water schemes consider communities to "own" their projects, the understanding is somewhat different. They generally hire contractors for construction and then "hand over" the system once it is built, requiring the communities to be responsible for maintenance, thereby "owning" the system. However, IDE considers "ownership" to be complete control over the future of the system. When a community or group initiates and manages the construction of the system, they maintain the right to add or exclude users, make operation and maintenance rules, and have the power to enforce those rules to the point of denying use rights for noncompliance. When the government is the primary motivator behind a water system, it is the project implementers—department or NGO staff, consultants, contractors—not the community, who maintain primary control over who gets to use the system.

## Ease of Encouraging Investment

The low cost of the systems also makes it easier for the community to request funding support from other NGOs, the VDC, municipality, and local line agencies. Because the amounts requested are low, funders are more willing to contribute. Government agencies can get acclaim for a small investment. Additionally, success in obtaining matching funds from other sources strengthens the understanding of community ownership of the MUS system.

Not only is the system low-cost, but the technology is easy to install or construct so it generally only takes a couple of months to complete, and farmers start reaping the rewards of the domestic water portion immediately and the productive-use portion a few months later as crops mature. For a government agency, showing such successful results in a short time with a small financial contribution is highly beneficial. This is discussed in greater depth in chapter 7 on the Learning Alliance.

### Quality and System Lifespan

On the downside, some believe that the focus on low cost has compromised quality, making system lifespan an issue that several villages and partner NGOs are concerned about. For example, villagers have complained that the tapstands are not robust enough. In Senapuk a drunk man kicked the tapstand and broke it. In other cases the livestock have damaged them. Although the tapstands may be more robust than the community believes due to these incidents, they are concerned that their maintenance costs could be too high if the system quality degrades. On the NGO side, they are hesitant to fully embrace MUS upscaling until system longevity and sustainability has been proven (one NGO quoted a five-year minimum requirement for trust in the quality of the system).

Despite doubts about system longevity, as more MUS systems are constructed, SIMI seeks to find design solutions to regularly occurring problems. For example, it became evident that some of the MUS systems had problems of air pockets in the transmission lines, which restricted flow and reduced performance, so air vent pipes were included in future systems to ameliorate this problem. Low cost does not necessarily equate to low quality. IDE continually seeks to find the best balance between cost and quality in order to present appropriate options for farmers to choose from.

## INCLUSIVE INSTITUTIONS

### FACILITATING LOCAL AND DISTRICT-LEVEL INTERACTION

There are several ways in which SIMI has attempted to facilitate the interaction between communities and other organizations at the local and district levels. For example, during water-rights negotiations, communities are encouraged to either provide the formal agreement to the VDC chairperson upon completion of negotiation or, better yet, request the VDC chairperson's presence during the negotiation process. Involvement of the VDC creates a more binding agreement and sometimes facilitates easier compromise between the two communities.

At both the local the district levels, partners contributing to the schemes (NGOs and GOs) are invited to participate throughout project implementation. The involvement of these partners throughout the whole process builds relationships between the community and organizations, improving villagers' ability to access resources. Furthermore, SIMI encourages the contribution of GOs to community trainings. For example, the DADO is often invited to provide one or more of the vegetable production trainings given in the community, filling in a key gap in the community's knowledge and abilities and connecting them with a useful technical resource. This increased interaction with government agencies encourages communities to tap into financial and technical resources they did not previously know were available to them. Additionally, communities realize that through developing a relationship with one stakeholder (either government or an NGO), doors to other stakeholders open for them. For example, in some cases, it was the DADO that connected the community with SIMI.

Due to these efforts at community building and facilitating communication between groups, positive changes were noticed by SIMI staff and the communities themselves. SIMI Social Mobilizer/Community Mobilizer staff said they noticed a change in attitude in some communities where people became more helpful to others and arguments in the communities decreased. Staff also noticed community members were more eager to share their knowledge with others. This desire to share with others manifested in greater connection with outside groups and other communities. The MUS communities interviewed said that before project intervention they felt very isolated from other communities, but through the project they received more exposure to other villages and what was happening in them. This piqued their interest in visiting other communities, sharing information, and discovering how to get new technologies and from what sources.

*"MUS can be an entry point for empowering the people."*—DoA Planning Division Director

## IMPACTS OF MUS ON WOMEN

Gender equity remains a challenge despite positive impacts of MUS systems. Women had less decision-making power and provided more of the labor throughout the MUS construction (60%, 55%, and 66% in Chhatiwan, Senapuk, and Krishnapur, respectively). SIMI does encourage at least 33 percent female representation on the WUC and recommends that women hold key positions such as chairperson, secretary, and treasurer. But the power is by no means equally shared between women and men. Gender composition on the committee remained the same for both Senapuk and Chhatiwan even after they transitioned from construction committee to WUC. Chhatiwan had the least female representation, only two of the eleven committee members. In Senapuk, three of the seven committee members were female. The gender composition in Krishnapur, however, changed from the beginning of the process; they began with two women on the seven-member construction committee and shifted to five women of nine on the WUC at the end of project implementation. Although the increase in representation of women on the management committee in Krishnapur displays an increase in women's decision-making role post-project, equal decision making is by no means universal in MUS projects to date.

Despite less inclusion of women on the WUC, in most communities the MUS project represented the first step toward increased gender equity. Follow-up meetings to MUS-system construction in Nepal found women represented at meetings as well as or better than men and speaking up more than IDE staff anticipated based on previous village experience. One of the female village motivators took the initiative to highlight a problem where river erosion damaged an irrigation canal. Having worked to solve problems for the MUS, she took an unprecedented initiative in rural Nepal to address even larger problems outside her official job description.

The vegetable production component of MUS has had a positive impact on women. In Nepal, it is women who have traditionally been responsible for growing the few vegetable plants near the home. The fact that MUS lets them grow more vegetables close to the house makes it possible for them to cultivate a significant quantity of vegetables and more conveniently perform household work. Therefore, women have played a significant role in vegetable cultivation in MUS communities, giving them much more say in cultivation decisions. Perhaps most striking is the impact of women's increasingly taking the vegetables to market for sale. Generally when money is brought home from the market, women either give the money to the male or report the amount received from sales and what was purchased with the money. Male financial dominance has not fully changed, but the direct sale of vegetables gives the women cash to purchase personal items without the embarrassment of requesting it from and justifying it to male members of the household. Of the three detailed case studies, the women in Senapuk seemed to be benefiting the most because of their direct involvement in sales.[10] The result was an increase in financial independence and self-esteem/empowerment for the women of Senapuk. In contrast, the men in Chhatiwan remained in the village, and even though they did less of the vegetable-cultivation work than the women, they remained the primary decision makers. And since the Chhatiwan community is largely Magar, there is less stigma for men to carry vegetables to market. The overall indication is that the more directly the women are involved in cultivation decision making and sales of vegetables, the more they benefit from the scheme.

Other aspects of MUS have also resulted in change for women. In Senapuk, some (but not all) of the cultural barriers around water collection by women during menstruation have decreased due to the project. In some villages the increased water has also allowed for increased latrine construction, cutting down on harassment when going to the toilet in the open and health problems from holding in their waste all day to prevent embarrassment.

### SHIFT IN POWER DYNAMICS

MUS has also had an interesting impact on caste. The Lele project in Lalitpur District is a prime example. A neighboring cluster had a stark split between lower-caste and upper-caste communities, and although their domestic water source was a tapstand that had been built by a Canadian project with equal unskilled labor contribution from all households, the upper-caste portion of the community prevented the lower-caste women from collecting water at the same time as they did, decreasing their water access. The Lele community members, also lower caste and Janjati,[11] decided to build a tap specifically for the lower-caste households in the neighboring community, and if the higher-caste households were also interested, they would have to jointly contribute labor for the hybrid tapstand. Due to the construction agreement, even though both the higher- and lower-caste households constructed it together, it is the lower-caste households that have priority use of the tap. Through the project, disparate parts of the community had to come together under one umbrella user committee. The Social Mobilizer from Lele stated that she learned that "we cannot work in isolation. A group is required because each and every person is dependent on others in these villages."

## ADEQUATE FINANCING

The Nepal cases illustrate the difficulty in finding opportunities to test the hypothesis that productive use can pay for the entire cost of domestic-plus systems. In Nepal, both domestic and irrigation "projects" are heavily subsidized. While individual households may choose to make a private investment to gain immediate benefits, no communities come forward to make collective investments when aware that government or programs from other organizations will provide subsidized inputs. And many households believe that it is the responsibility of the government to provide these services for them. The conclusion, sometimes additionally driven by politicians claiming they "will bring a project," is to wait until a project comes to them nearly free of charge.

On the other hand, SIMI MUS projects range from 24 percent to over 80 percent investment by the community of users, with the remainder coming from VDC grants, district and central-government grants, other related projects via NGO partners, and some share directly from SIMI. This percentage investment is actually much higher than is currently common in single-use schemes. And in order to ensure equitable investment per household, poorer households have been allowed to provide more labor to make up for their lack of available cash resources for investment.

The responsibility to search for additional funds rests in part on the community. This has some positive benefits in mobilizing community members, generating ownership, and spreading awareness of the MUS concept to government and other organizations. In fact, the need to search for outside funding was largely responsible for the expansion of partnerships and support of the MUS concept in Nepal (this is addressed more fully in chapter 7 on the Learning Alliance). Increasingly, communities that have heard about MUS from other villages have taken it upon themselves to acquire partial support from other sources as well as coming to SIMI to request assistance to implement the MUS approach.

Even with the low cost of the system and the microirrigation kits, some households have difficulty coming up with the requisite funds. So CEAPRED recommended improving access to credit, particularly larger loans than just the small revolving fund that the WUC has; farmers had mentioned to them their difficulty in purchasing the microirrigation technology or inputs and felt they could benefit from other ways to access credit. SORUP, IDE's implementing partner organization in Kaski District, added that matching funds for repair and maintenance would help the communities when problems arose because some communities have difficulty collecting sufficient funds.

Some of the very poor households even find it difficult to give the labor contribution to the project because that is time spent that is not earning them wages. In others, the wealthy are actually paying the poor to contribute the labor required by the wealthy household. According to SORUP, the poorest of the poor cannot transport the produce to the market because they lack money for transportation. Therefore they sell their produce to the rich people in the village to consume, replacing the vegetables the wealthy used to purchase from the market.

## CONCLUSION AND LESSONS

Affordable technologies and full participation in planning and design give full ownership of MUS. Ownership means assisting in finding funding and developing institutions for operation and management. Partnerships uncover new options and opportunities, actualizing water resource development in new ways, better meeting community needs, and developing the necessary links between organizations and communities. Community-based MUS are an excellent example of developing local governance skills and allowing communities to creatively find solutions to their water-use needs while building community strength and changing water-use behavior. Inclusion of a productive-use component enables individual action and community action to reinforce each other, improving the situation of both independent households and the community as a whole.

CHAPTER 7

# APPLYING THE LEARNING ALLIANCE APPROACH

Photograph by Monique Mikhail.

The Learning Alliance experience in Nepal was an experiment in working with all stakeholders at all levels to concurrently garner partner support for MUS project implementation and propagate the idea of MUS throughout the country. Although the MUS movement is still small, it has achieved a great deal of traction with communities, NGOs, and government, which can be seen most clearly in one outcome: the idea and construction of MUS systems will continue well beyond the CP-MUS project. This story has applicability to the upscaling of MUS globally.

Although the Nepal CP-MUS project did work to incorporate a formal Learning Alliance (LA) in its work, the expansion of the MUS concept occurred far more organically. Therefore, for the purposes of this chapter, we have chosen to broaden the conceptualization of "learning alliance" to include not just the formal set of relationships that were established to specifically represent the LA, but also all of the informal connections that were made; how the concept evolved within the minds of the implementers themselves; how the concept propagated through communities, organizations, and government bodies; and lessons/conclusions for scaleup drawn from all stakeholder impressions and ideas about MUS.

Information in this chapter is based largely on personal and group interviews that occurred during February–May, 2007. The individuals chosen were those within each government organization and NGO partner who had been the most involved in either MUS project implementation at the district level or the LA at the national level. Interviews at the national level were conducted in English, while interviews at the district and local levels were conducted in both English and Nepali with translation.

Interviews with IDE/SIMI staff at the national level included the following:

- Team Leader, SIMI
- Deputy Team Leader, SIMI
- previous Senior Engineer, IDE-Nepal; now Team Leader, Technical Assistance Microirrigation Project, DoI-NITP
- SIMI Engineer

Interviews at the local level included:

- group interviews with communities in Kaski, Syangja, and Lalitpur districts; personal interviews with a few leader farmers and local staff in these districts
- personal interviews with two Social Mobilizers—one working with the SIMI program and one working with the BDS-MaPS program
- focus-group meeting with Social Mobilizer/Community Mobilizer (SM/CM) staff during the annual area-level SIMI staff meeting in Kaski
- focus-group meeting with agricultural technicians, irrigation technicians, agricultural-marketing supervisors, and district managers

(AT/IT/MS/DM) during the annual area-level SIMI staff meeting in Kaski
- local implementing NGO in Kaski—SORUP Nepal

Interviews at the district level included:

- district partners—Helvetas-LISP, World Vision, District Agricultural Development Officer (DADO)
- attendance at Kaski workshop, report from Kaski workshop, report from Palpa workshop

Interviews at the national level included:

- NGOs
  - SIMI partners—Support Activities for Poor Producers of Nepal (SAPPROS) and Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED)
  - National Federation of Irrigation Water Users Association, Nepal (NFIWUAN)
  - World Vision
- Nepal Water for Health (NEWAH)
- IWMI-Nepal
- GOs. (For a diagram of the relevant government bodies see Figure 1.2 in chapter 1.)
  - Department of Agriculture (DoA)
  - Department of Irrigation (DoI)—Nonconventional Irrigation Technology Project (NITP)
  - Rural Water Supply and Sanitation Fund Development Board (called the Fund Board)
  - Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) housed within the Ministry of Local Development
  - Department of Water Supply & Sewerage (DWSS)—Community Based Water Supply and Sanitation Project (CBWSSP)

It was impossible to collect the information without bias, mainly because the interviewer was American. Bias in the interviews manifested in two ways: first, information, largely interviews at the local and district level, was lost or distorted during translation; second, it is suspected that the information given by government officials at the national level to some extent represented what these officials thought the interviewer wanted to hear. This was evident in the use of buzz words and the similarity in responses.

## THE LA PROCESS — BUILDING PARTNERS FROM THE GROUND UP

### FIRST STEP: SYSTEM CONSTRUCTION

See "MUS Team Structure and Operation" in chapter 2 for a review of the beginnings of MUS implementation by SIMI in Nepal. Because the conceptual evolution of MUS in Nepal started with IDE's microirrigation technology projects, its development addressed a need within the project and the communities. The actual MUS schemes began being built before the concept of a learning alliance was even introduced to SIMI staff. The fact that the concept of MUS in Nepal began with physical structures responding to a real need of the communities SIMI was working with had a great deal of influence on the success of its propagation.

### TWO-TIERED APPROACH

#### Practical Advocacy

The SIMI project had not initially planned for MUS in its development, so as the MUS process began, SIMI soon realized that the number of communities that could be impacted through the project would be severely limited if project funds were not strictly allocated. Thus, a maximum budget allocation of NPR 30,000 ($428) per scheme was established for the first year of implementation. This was increased to NPR 40,000 ($571) for the second and third years. Considering that each MUS scheme costs at least NPR 100,000 ($703) to construct (some are up to NPR 300,000–400,000 or $4,286–$5,714), extra financing had to be sought. This funding crunch is what pushed SIMI to begin seeking matching funds from other sources. And it was the process of searching for partners that inadvertently developed MUS advocates at the local and district levels.

From the very first project with Chhatiwan Tole (chapter 3) of Chirtungdhara VDC, matching funds were sought to supplement the moneys that SIMI had available for the project. For Chhatiwan Tole, SIMI had already been partnering with Helvetas' LISP program so their support was an easy fit. Additional funding was requested from the local government (VDC). This set a precedent to look for matching funds from both NGOs and government and paved the way for future partnerships and MUS advocates. In 2003 the DADO, the District Soil Conservation Office, and DoI started contributing to the schemes as joint projects in Palpa, Surkhet, and Syangja districts.

Both the communities and SIMI staff (at the local, district, and national levels) have been involved in securing funding. Communities, assisted by SIMI Social Mobilizer/Community Mobilizer staff, sought funding from the VDC, NGOs working in their area, the District Development Committee (DDC), and district-level line agencies, while national-level SIMI staff garnered funding from NGO partners and government agencies at the national level. SIMI maintained a focus on local funding, searching for support at the national level only when necessary.[1] Each district team had a unique approach to seeking matching funds, largely depending on the approachability of government officials in the district (i.e. the Chief District Officer) and the presence or absence of I/NGO projects. Some MUS schemes were built in partnership with up to 4 or 5 organizations. For example, the 45-household Kumalgaun project of Syangja District obtained financial support from the Soil Conservation Office, DADO, the local school, a local club, and SIMI. And while in all schemes the communities contributed labor and local materials, in some schemes they also contributed cash. Although it often took multiple meetings with the same official, funding was usually obtained. This had the benefit of building rapport between the community and potential partners from the very beginning of project planning.

In order to build momentum for MUS, SIMI arranged many informal meetings with potential partners at the district level. As the MUS project progressed, communities were increasingly referred to SIMI by an established GO or NGO partner with promises of partial funding.

SIMI and the communities built upon this initial rapport by extending invitations to partners to attend village-level meetings, consultation meetings, and trainings throughout the process. Partners became a part of the implementation process, building linkages between all stakeholders. Exposure visits were held, including visits of one community to another, of potential partner NGOs and GOs, and of national-level officials and international visitors. This proved to be a powerful and practical advocacy technique.

## Conceptual Advocacy

About a year into the project, the concept of learning alliances was introduced to SIMI staff, and they began the more deliberate process of establishing an LA and sharing the MUS concept. This more conceptual form of advocacy occurred predominantly at the national level, although there were district and local activities as well. SIMI staff created a MUS brochure for initial outreach activities and began holding individual meetings with potential LA organizational partners at the national level.

***National-Level Efforts*** On September 16, 2005, IDE-Nepal and SIMI organized the first National MUS LA Workshop in Kathmandu with about 100 people in attendance. This meeting, which included representatives from all levels, was organized to launch the MUS LA concept and garner interest from potential MUS partners. The concept of MUS was introduced, including the technologies SIMI had used to date, and advantages of the projects already completed were shared by community representatives. At the end of the meeting, SIMI requested that organizations who were interested in joining the LA step forward; five organizations did so: NFIWUAN, the Fund Board, DoA, DADO of Lalitpur, and Kathmandu University.

Six months later, a follow-up 2nd National MUS LA Meeting was held with about 20 individuals from the organizations that had previously expressed interest and two other key organizations that IDE felt were essential to get on board—NITP and WaterAid. This meeting had an important outcome for the LA: it was agreed that NFIWUAN would become the coordinators of expanding MUS projects and the MUS concept at the district level. NFIWUAN has a large network of water-user groups and branch offices in 62 districts; they also have a committee where representatives from the Local Development Ministry, DoA, and DoI sit together and discuss the problems of water users; and their leadership was interested in propagating the idea of MUS. It was agreed that a partnership would be piloted in Lalitpur and Tanahun districts with NFIWUAN assisting in site selection, source identification, and social mobilization, while SIMI would provide technical support.

At this follow-up meeting, WaterAid expressed preference for the Federation of Water & Sanitation Users Nepal (FEDWASUN) to play a more primary role instead of NFIWUAN because NFIWUAN's experience was mainly with surface irrigation whereas the FEDWASUN had more experience with piped supply and would lend better experience. WaterAid added that the FEDWASUN was growing as an organization and therefore was more active than NFIWUAN. However, IDE staff felt that NFIWUAN's organizational network in 65 of the 75 districts in Nepal and its connections with a host of organizations—government, private, donors, and civil society—put them in a better position to manage the LA. Conversely, FEDWASUN was a nascent organization with few established contacts and a smaller network.

One week later IDE staff met with key NFIWUAN representatives to work out a plan of action for both implementation of MUS projects and the MUS LA. NFIWUAN expressed that they did not currently have the funding to implement such projects, but that they had potential to raise money within the organization.

Subsequently, IDE decided to take some key LA partners for an exposure visit to Syangja and Kaski districts. This visit included NFIWUAN staff from Lalitpur, Kaski FEDWASUN central-level staff, DADO from Tanahun District, and DADO from Kaski District.

At the same time there was a meeting between interested individuals within Kathmandu University and SIMI to discuss their role in the MUS LA. The idea was to write a joint proposal to fund MUS research. This, however, has not come to fruition because the university needed funding support that SIMI could not provide. The only outcome of the partnership was the thesis work of one masters-level graduate student.

After the aforementioned field visit, IDE's BDS-MaPS program wanted to construct a MUS project in Lele village of Lalitpur District and was requesting funding from DoI-NITP and DADO-Lalitpur. IDE staff felt that it would be

**Figure 7.1 A community WUC representative describes the benefits of MUS at the Kaski District LA Workshop**

Photograph by Monique Mikhail.

beneficial to combine this practical advocacy with conceptual advocacy and hold a joint national and Lalitpur District LA workshop. This second LA workshop, held on May 26, 2006, resulted in two major outcomes: a promise from NITP to fund NPR 100,000 ($1,429) of the Lele scheme and DADO-Lalitpur to provide agricultural extension support.

***District-Level Efforts*** In the beginning of 2007, IDE staff felt that the district teams should follow the national-level approach and integrate practical and conceptual advocacy. This resulted in the planning of district-level LA workshops for Kaski, Palpa, and Lalitpur districts (see Plate 1 for a map of the MUS project districts). Kaski and Palpa districts were chosen for workshops for two reasons. First, another IDE project goal consisted of building ten additional MUS systems in these two districts. Second, staff realized that there were several more NGOs in these districts that were well positioned to become involved in MUS construction if the information were disseminated to them about MUS. Lalitpur District was chosen due to its proximity to Kathmandu and thus had the potential ability to encourage interaction between district- and national-level organizational representatives.

The Kaski workshop was held on March 29, 2007, in Pokhara (see Figure 7.1). Organizations that SIMI had already worked with in the district were invited as well as new potential partners. The first half of the meeting included presentations by SIMI, community WUCs, DADO, and NITP to explain the MUS concept, how the projects had taken shape in their districts, and the community-level outcomes since project completion. The second half of the workshop was a breakout session into smaller groups that discussed the roles,

**Figure 7.2 A community WUC representative shares his experience at the Palpa district workshop**

Photograph courtesy of SIMI.

barriers to scaleup encountered, and areas of improvement in operations of various stakeholders—GOs, NGOs, local government, and communities. The Palpa workshop was held on April 23, 2007, in Tansen and had a similar structure to the Kaski workshop except that instead of breakout groups in the second half, all attendees together held a group discussion about the roles of GOs, local government, and NGOs, and a potential working modality of future MUS efforts (see Figure 7.2).

The Lalitpur District workshop was another joint district/national workshop held on July 2, 2007, with NFIWUAN acting as coorganizer in support of IDE. This workshop focused more on presentations by key national-level representatives and discussion about the way forward with MUS nationally. Bilateral follow-up meetings are being established between SIMI and all of the interested organizations listed above.

## INFLUENCE OF INTERVIEWS

The interviews helped to crystallize support of organizations that had previously shown lukewarm interest, particularly at the national level. National-level representatives of various GOs with higher status awarded the American interviewer meeting times that would have taken much longer for Nepali staff to arrange and would have been much shorter. Additionally, in multiple interviews, feedback was received that going through the interview process helped the interviewees solidify their understanding of and interest in MUS.

## PARTNER CONCEPTUALIZATIONS

Understanding the way that partner organizations conceptualize MUS is essential for understanding the progression of the LA and the potential for MUS scaleup in Nepal.

### UNDERSTANDING OF MUS

The first question asked in interviews was how the interviewee would define MUS. Several different conceptualizations were revealed. Sometimes individuals would describe MUS in multiple ways, while at other times interviewees were very firm in their specific definitions.

#### Dual vs. Multiple Use

There was disagreement among various stakeholders about whether MUS had dual or multiple functions. Several stakeholders, including a local partner NGO, DADO, and World Vision, conceptualized MUS as only having two purposes— drinking water and irrigation water. One DADO representative was particularly adamant that it was only dual purpose. This was repeated by other attendees of the Kaski District workshop who said that it was misleading to call it multiple-use water systems instead of dual-use water systems. In the DADO representative's perception, the communities were also not always using the water for domestic purposes other than for drinking. An NITP engineer countered by saying that any system used for more than one purpose was MUS.

Others were more inclusive of additional uses for MUS systems. NEWAH and NITP explicitly mentioned cattle watering as a use[2] but emphasized drinking and irrigation as the primary purposes. The Fund Board water and sanitation engineer included microhydro in his definition but subsequently emphasized that drinking water is the primary purpose with microirrigation inclusion contingent on sufficient source flow. Helvetas-Palpa also included microhydro in their description of MUS.

NFIWUAN had the broadest definition, although at the base it assumed one sector in control of the project. NFIWUAN's definition of MUS was "from one irrigation system or one drinking water system, water can be used in different sectors." When pressed further, drinking, irrigation, hydropower, agriculture, and other industries were listed.

#### Not a New Concept to Villagers

Some that were interviewed maintained that MUS was not a new idea and was simply a representation of what villagers in Nepal have been doing for years. The executive director of the Fund Board typified those who visualized MUS this way. He explained, "it is what people have been doing in Nepal since birth." The DoA chief from the monitoring and evaluation (M & E) section said that he was originally a farmer and had used the same water for multiple purposes all his life but that farmers did not know how to properly manage the water on their land. He thought that the MUS project was necessary for Nepal because it legitimized long-established water-use practice and was a valuable way to teach farmers how to apply more efficient water management.

The Helvetas-Palpa representative said that although MUS was new terminology, the idea has already been applied in Nepal. He mentioned that they were supporting a surface-irrigation system that was also being used for hydropower, and he highlighted some of their projects where they collect domestic wastewater in a tank and distribute it through irrigation canals.

The NFIWUAN representative stated that farmer-managed irrigation systems were de facto MUS and that farmers had practice using water in multiple ways without deliberately planning it that way. He further suggested that MUS was actually just a term for traditional irrigation systems in Nepal. The NITP engineer described MUS as the traditional techniques of developing a water supply to integrate the provision of domestic water with that for productive uses like cash-crop irrigation, fish ponds, and livestock.

### Vehicle for IWRM

The representative from the DoA Planning Division delineated the social and economic components of MUS by describing it as "tapping the natural source of water in such a way that the community benefits in terms of meeting the household needs plus generating some economic activities." He went on to explain that MUS is "the optimum use of water in a sustainable way" and mentioned that for the DoA it was a new approach to water resources. This broad definition was mostly reflected in the answers of individuals who had worked with water resources and were familiar with the Integrated Water Resource Management (IWRM) concept.

Others went further and actually mentioned IWRM. The Fund Board said that MUS is different terminology for the IWRM concept and that the crux was to manage water properly. The NITP engineer, when giving his talk during the Kaski workshop, said that MUS was a way to "realize the true sense of IWRM." He mentioned the national water plan and said that the government was good at planning for IWRM but less successful at actually implementing it. He suggested that MUS be used as a way to actualize the IWRM concept.

### Other Definitions

Some NGO partners saw MUS as more of an appropriate technology than a concept. CEAPRED mentioned that MUS was a "strategy, not an objective" for their organization and that it is simply a technology that allowed for water to be properly utilized. World Vision also saw it as an appropriate technology.

Others discussed MUS as a tool for sustainability. SAPPROS mentioned that MUS was only useful in areas where water was scarce and was simply the use of excess drinking water for irrigation. The M&E Chief of DoA described MUS as a way to tap water sources without exhausting them quickly. DoLIDAR said that MUS was "planning to make the proper use of water." IWMI-Nepal saw MUS as a scale-based concept: something that was primarily developed to address small-sized water needs and would not apply on the larger level.

## RELEVANCE OF MUS FOR NEPAL

### Water Availability vs. Access

Most people interviewed emphasized the irony of fate that Nepal is the second most water-resource-rich country globally and yet most of their population has difficulty accessing water. Compounding the incredibly uneven seasonal rainfall patterns (explained in chapter 1) and geographical complexities of development in much of Nepal, effective distribution and utilization of water resources remains a struggle. Some interviewees mentioned that particularly in the hills there is little opportunity for irrigating and that source sizes are insufficient for constructing typical larger drinking water systems. Most thought that water could be more efficiently and effectively used through MUS.

### Effective Use of Water Sources

Several individuals also highlighted that, particularly in the hills of Nepal, there are many small sources of water available for small rural communities to use. The Deputy Director General of the DoA Planning and Human Resource Division said that he was "excited that there was a way to use them [small springs] to benefit the communities." The fact that MUS has identified the type of technologies that can effectively use these small sources for multiple sectors was seen as a great boon to MUS.

Although most mentioned the hill region of Nepal as the most likely to benefit from MUS, that could be due to the fact that SIMI had worked on MUS in these areas. However, the Chief of M&E at DoA extrapolated from current MUS projects to say that MUS would be a cost-effective way to make drinking water more easily available in the Terai. If, in addition to providing drinking water, bore wells and pumps were installed for irrigation, the irrigation component should pay for the drinking water component. He also mentioned the relative ease of kitchen gardening in the Terai versus the hills due to the flatness of the land.

### Helpful to Poor and Low Cost

Others who were interviewed stated that MUS was relevant to Nepal because it was helpful to very poor farmers with small landholdings. NITP mentioned involvement of even the poorest of the poor and the affordability for farmers who have not traditionally had access to water for productive use. The provision of a revolving fund in certain districts is an additional incentive for communities. His perception was that the recovery rate to date of MUS systems was 100 percent. The MUS systems in conjunction with microirrigation technology have allowed farmers to increase vegetable production with subsequent gains much higher than initially envisaged. These positive outcomes have led many to view the benefits of MUS as far outweighing the costs. And some even picture the cost effectiveness in a broader context. The Deputy Director General of the Planning Division of DoA saw the investment reduction possibilities in building MUS instead of two separate systems (drinking water and irrigation supply).

One major component of the cost effectiveness that interviewees mentioned was the short-term payoff. Not only did systems only take a few months to complete, but farmers started seeing the rewards within one growing season, enabling them to earn back their investment in MUS and the accompanying microirrigation kits quickly. Organizational contributors to the system could see the benefits of their investment shortly after it was made, leading to a variety of manifestations that will be mentioned later.

## Community Involvement

A few individuals felt that MUS was most relevant to Nepal because of its community ownership approach. The Fund Board claimed that the most critical change was the social development that occurred when people worked together for the common goal of MUS. NEWAH suggested that through MUS, people in the middle hills would become more aware about the appropriate use of water and would be able to then share their skills with other areas of Nepal. Helvetas-Palpa mentioned the relative ease of the MUS-system operation and management for communities as compared to more standard water-delivery systems in the hills.

## Small Change from Current Design with Large Payoff

On the other hand, several people believed that MUS systems were only a small diversion away from the way water is supplied to hill communities currently; with only a small shift in design, a large benefit could be garnered by communities. According to the DADO representative, all districts have an irrigation budget with some money earmarked for pipe irrigation that could be used to construct MUS for a more beneficial outcome.

The engineer from NITP said that MUS systems were a “good combination of traditional thought and modern technology” with minimal extra management effort and cost but large returns. He had calculated with his own data from Rajyachhap in Ramechhap District that the difference in cost between a traditional drinking water system and MUS was only 37 percent, yet on 0.075 ha of land a farmer could cultivate eight varieties of vegetables.

The Deputy Director General of DoLIDAR referred to the master plan they are currently creating for optimal use of water in small watersheds of nine districts. He felt the government climate was ripe for MUS because of the current shift toward optimal-use planning at the district level.

### Other Thoughts

Other thoughts on the relevance of MUS for Nepal included:

- A way to make the area near the house more productive
- It is important for gender equity because women can work in the garden and earn some money for more financial independence.
- Irrigation of land less frequently used for agricultural production. In the past farmers were limited to land where irrigation facilities were available, but now bari land has become more important than khet because it is earning higher returns.
- Reduction in soil erosion with use of microirrigation
- If more vegetables are produced in Nepal, more money will stay in the local economy instead of going to vendors from India.
- A way to improve health

## CHANGE OF IDEAS THROUGH INVOLVEMENT

Involvement in MUS projects definitely had an impact on all involved, particularly in their conceptualization of water resource management. For example, a representative from SORUP, one of IDE's local implementing partner NGOs, said that he had learned how to convert land: "I never thought that the area that was dry like desert could be productive, but through MUS it has become green." World Vision was surprised that after participating in one pilot study in Kaski, neighboring communities were requesting MUS systems from them. Although they had been very hesitant about MUS at the onset of the project, this feedback confirmed its value. And CEAPRED staff said they had learned that efficient water resource management is a practical possibility, not solely an aspiration.

The NITP coordinator said that his concept of MUS has become more complex through involvement in the MUS project. It has raised a concern for him that due to population growth, small water sources will be incapable of supplying sufficient water for both domestic and irrigation uses in the future, causing systems that are currently MUS to ultimately be redesignated solely for domestic purposes. Through involvement in MUS implementation, he has honed his idea of which projects are appropriate for NITP involvement.

The Deputy Director of the DoA Planning Division said that MUS has encouraged a new type of institutional collaboration. Although prior there was institutional collaboration on the supply side, it is now on the demand side. He said that the farmers are the force making government institutions work together to adequately address the farmers' needs. The Chief of DoA's M&E

section declared that through working with MUS, he has decided that MUS scaleup is essential, and he is beginning to think about future possibilities.

Even SIMI staff's thoughts have evolved through the MUS project. At the AT/IT/MS/DM meeting in Kaski, staff stated that due to existing practices prior to MUS, they believed that water resource development schemes were necessarily expensive. After MUS implementation they realize that it can be done much more cost-effectively. They also noticed a difference in farmer contribution: prior there was low contribution from farmers, but due to the small investment required, fast returns, involvement of women, and scheme ownership, they have become much more willing to contribute. One Irrigation Technician was also skeptical that the area under vegetable production would actually increase in the villages post-project, but she has seen this transformation firsthand.

## BENEFITS/DRAWBACKS FOR ORGANIZATIONS INVOLVED

Although most organizations highlighted the changes they had seen in the communities, they agreed that there had also been positive impacts for them. All organizations said that if their target community benefited, then they as an organization felt successful. CEAPRED, a SIMI partner working directly with communities, mentioned that MUS had eased the process of microirrigation technology uptake, making work for their staff much easier. The M&E chief echoed this sentiment, citing that the farmers now see the DoA in a more favorable light, making their work easier.

As a small local organization, SORUP said that through MUS projects their staff skills have been developed, and they have learned more about community wants and needs and how to better assist vulnerable communities. Donors have been impressed with their MUS work, which has legitimized them as an organization and allowed them to launch new programs. The Deputy Director General of the DoA Planning Division mentioned that they, too, have benefited from knowledge gain.

World Vision stated that since their target is children, MUS has been a great way to reach their target community, particularly the nutritional aspect of projects. Their Kaski District office has benefited because they are able to share their knowledge and technology with their other nine districts offices in Nepal. They also benefit from the partnership with SIMI through knowledge gain and exposure. But predominantly they were pleased that they could share MUS successes with their donors in Australia. On the flip side, World Vision mentioned a downside to working with SIMI on MUS: World Vision supports organic agriculture and does not advocate the use of agrochemicals, but because SIMI gives training on the use of agrochemicals, communities are now requesting them from World Vision.

Helvetas-Palpa mentioned that technical development from their partnership with IDE was the main benefit they were receiving. Additionally, since they acted more as a donor on MUS work, they were pleased that it was cost effective and currently appears to be sustainable.

The NITP coordinator mentioned that his staff was able to see the direct benefits of the project they were contributing to. Whereas for large projects it is difficult to see direct community benefits, with MUS systems a large change in the communities could be witnessed within a short amount of time. This has boosted the morale of NITP staff and motivated them to work more on smaller projects. (As will be discussed below, a desire to work on small projects is unusual for DoI staff.) He also brought up the positive impression on visitors and subsequent accolades NITP received. Most notably, the DoI Director General visited a few MUS projects and was amazed at the impact, making it much easier for the NITP coordinator to advocate for future funding.

## DIFFERENCES BETWEEN MUS AND OTHER WATER RESOURCE DEVELOPMENT PROJECTS

Many interviewees said that one major difference between MUS and other water resource development projects in Nepal was project size. While most water projects are built for larger populations using bigger sources of water, SIMI works in areas with water scarcity, benefiting individual farmers and small communities, particularly the poor and marginal farmers. The small size also reduces the cost and the time frame, as mentioned above.

NITP also pointed out that the coordination of MUS was very effective. IWMI-Nepal stated that the MUS systems were more easily managed than typical water resource systems because they used simple technology.

At the SM/CM meeting, SIMI staff stated that they believe there is better community buy-in with MUS because it satisfies different groups of individuals—those more interested in the domestic component and those more interested in the irrigation component. They thought that the provision of a well-functioning management committee and caretaker at the community level helped make the systems more successful. And awareness creation on effective system management within the community was a critical component. They felt that due to the significant community contribution to system construction and full management responsibility, the community fully internalized ownership.

## SHARING OF THE CONCEPT

Much of the spread of the MUS concept in Nepal occurred through partner organizations. Most partners said that they utilize all opportunities for MUS advocacy, sharing the concept within their organizations, with village communities, donors, other partners they work with, and at meetings and conferences. The idea spread organically through the existing and growing networks of stakeholders associated with MUS. The more bought-in to the idea the person explaining it was, the more he shared it with others. However, even if the person was not a strong MUS advocate, once he began sharing the idea and receiving positive feedback, he became a stronger advocate. This was most true if a field site visit accompanied the explanation. See Table 7.1 for a detailed list of organizations with whom partners shared the MUS concept and some of the outcomes and responses.

**Table 7.1: Sharing of the MUS concept by partner organizations**

| Organization | Group/Organization/ Person They Shared MUS with | Connection to That Organization | Outcome/Response |
|---|---|---|---|
| | Partner organizations | | |
| | Communities they work with | | More demand for MUS |
| | Local government officials | | |
| **CEAPRED** | Secretary of the Ministry of Agriculture | SIMI advisory board | CEAPRED was asked to promote microirri gation technology and MUS through another project because of their familiarity with the programs through SIMI |
| | Fund Board | | They have not implemented MUS |
| **SAPPROS** | Communities they work with | Poverty Alleviation Fund project and community infrastructure projects with DANIDA and Rural Community Infrastructure Works | More demand for MUS |

| Organization | Group/Organization/ Person They Shared MUS with | Connection to That Organization | Outcome/Response |
|---|---|---|---|
| SORUP | DADO-Kaski | | Funding support for MUS projects; this particular DADO has become a strong MUS advocate |
| | VDC councils | Weekly meeting with 5–6 VDCs in the area | Exposure visits arranged; 3–4 requests from other communities in these VDCs for MUS projects |
| | Munucipal Development Corporation | | Shown interest but not yet given financial support; provide legal assistance such as certifying the source and providing public land for the tanks |
| | District Irrigation Office | | Shown interest but not yet given finacial support |
| | Forest Service | | Permits to dig pipelines |
| DADO-Kaski | All other DoA staff in the region | Quarterly regional review meeting | Most liked the idea; one DADO representative did not like SIMI because felt that SIMI took credit for his work; SIMI-Nepal spoke with this DADO representative and worked through the dispute |

| Organization | Group/Organization/Person They Shared MUS with | Connection to That Organization | Outcome/Response |
|---|---|---|---|
| DADO-Kaski | World Vision | Have an MOU with them for agricultural backstopping | Encouraged World Vision to support the pilot MUS project at Patneri in Kaski District |
| | DDC | Through a planning committee he is a member of, he is encouraging them to use their Trust Fund money for MUS | Farmers are demanding drip irrigation but not MUS; if farmers demand MUS, the Fund will invest in it |
| World Vision | 9 other district World Vision development programs within Nepal | Within WV | Others are waiting to see a longer-term impact from the project to make sure it is sustainable |
| | 20 partner organizations in Kasi | Work on projects with them | Waiting to see long-term impacts |
| | Farmer's Forum—monthly platform at the regional level to get farmers, political leaders, government officials, businesses, journalists, and local NGOs together to discuss farmer issues | Collaboration tool they set up | |

| Organization | Group/Organization/ Person They Shared MUS with | Connection to That Organization | Outcome/Response |
|---|---|---|---|
| | DADO in the districts where projects are | | |
| | National Agriculture Research Council | | Have arranged field visits |
| | Forums where the NITP Coordinator presents papers | | |
| NITP | Ministry of Water Resources, Water and Energy Commission Secretariat, retired officials and director generals of other agencies | Irrigation day at the national level | Presentation of the Lele case study; still some perception that irrigation should do bigger projects although most people think they are on the right track |
| | DWSS | Part of Subproject Management Unit (SMU) technical team for LEMI project | Suggested to go with DoLIDAR instead of them because they work on larger projects |
| | DoLIDAR | Part of SMU technical team for LEMI project | They are thinking of incorporating microirrigation in general in their work, but may use the MUS approach as well |
| | Department of Women Development | Part of SMU technical team for LEMI project | |
| | Society of Irrigation Engineers | Presentation at their national forum | Positive feedback on the concept |

| Organization | Group/Organization/ Person They Shared MUS with | Connection to That Organization | Outcome/Response |
|---|---|---|---|
| **DoA-Planning Division** | Other colleagues at the DoA | Microirrigation training module—MUS is cited as an example in this | |
| **DoA - M&E Section** | Within DoA - Engineering Director, Director General, Planning section Director, Agriculture Development Officers of all districts | Gives regional workshops and visits all district offices | The concept is good but adjustment in policy is necessary to really include the drinking component |
| | Head engineer of DWSS in Palpa District | Palpa LA Workshop | We agreed that using the excess water from drinking water projects (for projected population growth) for productive use now is a good idea |
| **Fund Board** | DoI | Bilateral meetings | |
| | Poverty Alleviation Fund | Bilateral meetings | |
| | All staff in the Fund Board | | |
| | Support Organizations | Through technical manuals on microirrigation technology | |

| Organization | Group/Organization/ Person They Shared MUS with | Connection to That Organization | Outcome/Response |
|---|---|---|---|
| **NEWAH** | Other five offices of NEWAH | | Presentation/internal discussion about MUS |
| **Helvetas-Palpa** | DoI | Observed field work | Were impressed and convinced they should use their funding on MUS activities |
| | partner organizations | They meet quarterly with partners | |
| | DDC | Local-level meetings | |
| | VDC councils | Local-level meetings | |
| | Other development organizations | In development forums | |
| **NFIWUAN** | Member water-user groups | Informal meeting with agenda item about MUS | |
| | Central level within NFIWUAN | Meeting | |
| | Andhi Khola Users Association | | |
| | 5–6 users associations in Syangja and Palpa Districts | | |

| Organization | Group/Organization/ Person They Shared MUS with | Connection to That Organization | Outcome/Response |
|---|---|---|---|
| NFIWUAN | NITP | | |
| | Central committee member of the Communist Party | | |
| | former agriculture minister | | |
| | Intellectual Resource Mobilization Group | | |
| | National Forum for Advocacy Nepal (NAFAN) | Another organization that some people within NFIWUAN are affiliated with | |
| | 3–4 members of ADB bank in Galyang | | |

## LOCAL BARRIERS TO MUS SCALEUP

### Differences in Socioeconomic Status

One concern of a few NGOs was that the socioeconomic disparity in villages could cause problems because the purchase of microirrigation technology might be too costly for the poorest households. There was a particular concern for the landless who would be contributing to scheme construction but not be able to utilize the productive-use water.

### Availability of Water

Some saw availability of water as a potential barrier. If there is no water available or it is already being used by other communities, then a MUS system cannot be built there. As NEWAH expressed, source sizes in the hills may not be large enough to supply bigger settlements. NITP's concern about future irrigation potential with use of small sources for MUS is influencing the projects they will support. Concentrating on areas where water is abundant enough for both uses well into the future limits the location of NITP-supported MUS projects, particularly in water-scarce areas.

### Too Costly

Some individuals were worried that MUS would be too costly. This argument was largely given by those who had not yet been involved in implementing MUS projects. For example, the Fund Board was concerned that if irrigation were included with drinking water projects, it would increase the amount of contribution requested of villagers, thereby decreasing buy-in.

While this argument was largely disproved by actual project outcomes, there were other cost concerns based on implementation experience. SORUP worried about communities where bari land was further from the houses, increasing the cost of the transmission line. The DoA M&E Section was apprehensive about working with communities whose only available source was at a cost-prohibitive distance from villages. A DWSS limitation mentioned at the Palpa LA workshop was the cost of treating water for smaller projects. It is costlier to supply treated water to a small number of households. And if treated water is then used for irrigation (as in the double-tank, two-line distribution systems), it is a waste of financial resources. However, if the overflow from the domestic tank would alternatively not be captured, then this may not be the case. This begs the question, "what happens to excess water in a DWSS system that is not needed for domestic purpose?"

### Potential for Water Conflict

A major concern of some interviewees was the possibility of water conflict. Both NEWAH and the Fund Board were worried that by providing irrigation water in addition to drinking water, irrigated land area would increase and upstream users would use too much, harming the downstream users and causing conflict. NEWAH raised the potential for disagreements over location of tapstands in the villages and water access. While SIMI has had experience with these types of disagreements, they are often solved by community buy-in and participation through the WUC.

### Difficulty in Registering WUC

At the Kaski LA workshop individuals indicated that the procedure for registering the Water User Committee (WUC) was too difficult. The District Water Resource Development Committee is responsible for deciding source allocation. Yet frequent absences at committee meetings prevent a full quorum for decision making, causing delays in action and frustrating the community. One individual said, "the problem is not the system; it is the systematic behavior of those in charge."

*"The problem is not the system; it is the systematic behavior of those in charge."*
—breakout group during Kaski LA Workshop

### INGO and NGO Barriers

One breakout group at the Kaski LA workshop outlined several NGO barriers to scaleup as well. Most agreed that NGOs do not have enough funding for wide upscaling of MUS and that it is the government's responsibility to fund MUS. Another constraint mentioned was donor influence limiting the flexibility of NGOs to act. Some felt that there should be a uniform implementation procedure between NGOs for MUS because communities are sometimes playing one NGO off the other to fulfill certain demands. World Vision reiterated this sentiment and claimed that a more cohesive joint monitoring-and-evaluation team between SIMI and partners was needed. Another barrier described was the difference in planning sessions between organizations, which did not allow them to plan together and provide joint funding easily. Political instability in the country and the difficulty of working in high conflict areas was also listed as a constraint.

### Other Barriers

SORUP mentioned the potential problem that in some areas the source quality might not be good enough for drinking water. IWMI-Nepal saw access to markets and infrastructure as the primary constraint to MUS because villagers might be less willing to put money into the scheme and microirrigation technology if they lacked access to input and output markets. He cited linkages with agriculture extension as a potential solution. At the Kaski LA workshop, lack of sufficient exposure to technical solutions for water resource use was considered a limitation. And, the varying approaches of NGOs and government organizations toward project implementation sometimes limited effective coordination between the two and did not necessarily match the communities' ideas of what they wanted. Attendees at the Palpa LA workshop also described the poor unity between people of varying castes and neighborhoods as a major impediment to MUS at the local level.

## GOVERNMENT BARRIERS TO SCALEUP

### General Government Barriers

The most commonly listed problem with all government bodies was a lack of coordination and communication within, between, and among them. For example, the Director General of DoLIDAR is part of the coordinating body of the NITP pilot MUS project (this project, called LEMI, will be described later) yet his Deputy Director had heard virtually nothing about MUS when interviewed. Government interviewees mentioned that it was difficult to coordinate with other GOs because of their different policies and planning. Each GO simply wishes to

> *"Coordination between, within, and among government agencies is a huge barrier."*
> —CEAPRED Executive Director

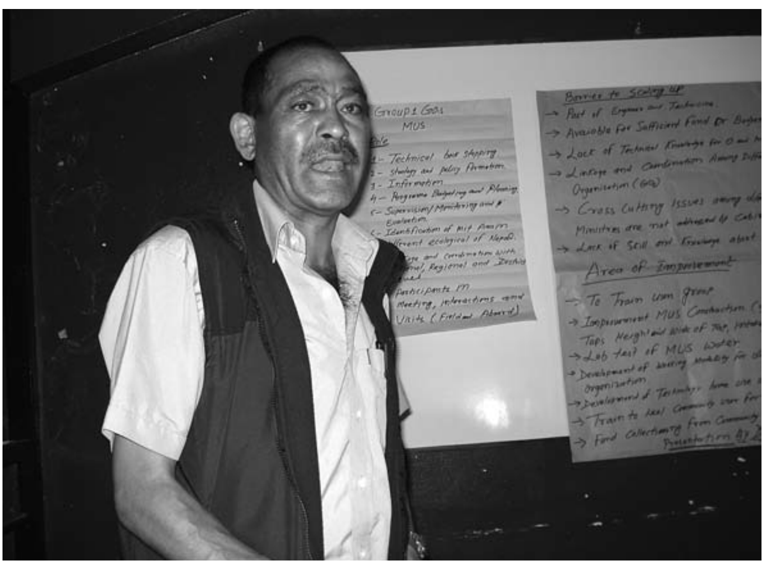
meet their own plan with their own effort and minimize work with other GOs. Exacerbating this are counteracting policies within various ministries on some cross-cutting issues. Although a program like MUS is inherently interdisciplinary, Helvetas-Palpa felt that future MUS development should seek to include the fewest number of GOs possible to minimize the complexity of coordination.

World Vision suggested that the attitude and knowledge of individuals within the government had a huge impact on whether or not MUS would be able to achieve wide scale expansion. Political influence in providing projects for certain communities was seen as a hurdle for a larger scale push. Another major problem mentioned was lack of exposure to the idea. NEWAH explained how the bureaucracy in Nepal was not interested in change or attempting new things and that the entire structure of the government was designed to hold back someone who was attempting to be innovative. Another major problem heralded by most participants was the lack of government funding available for such type of innovations.

## Local Government (VDC and DDC) Barriers

At the Kaski LA workshop there were several local government barriers delineated by participants (see Figure 7.3). First and foremost, the recent political situation in Nepal has been rough on local governments. While the DDC and VDC used to have elected committees to run them, due to the instability in recent years committee elections have been suspended, leaving only the

**Figure 7.3 The District Agriculture Development Officer of Kaski describes the barriers to scale-up discussed in his breakout group during the Kaski District LA Workshop**




Photograph by Monique Mikhail.

appointed VDC Secretary and the Local Development Officer in charge. And, in many VDCs, there has not even always been a Secretary. Without an effectively functioning and accountable local government it is difficult to upscale any type of project.

Planning can also be difficult because government budgets are never released on time, so even if money is allocated for MUS projects, the local government is not timely in delivering the funds, making it difficult for NGOs and communities to plan around the funding. What makes matters worse is that the planning schedules of the government are different from those of NGOs, making matching funding a difficult task. But, government officials also have difficulties in the way NGOs approach planning. The Kaski Local Development Officer said that NGOs and communities come to him with pre-planned projects and he is forced to either accept or reject them wholesale without the freedom to be part of the planning process.

Sometimes the government agrees to give matching funds for MUS projects, but delivery of materials and funds is delayed due to extensive bureaucratic processes and the cost of the MUS scheme increases daily during the delay. For example, in one project in Palpa it took two years to get the government payment. And, according to government rules, scheme estimation must be based on the district rate for materials. However, the district rates and the market rates are vastly different because the district office very rarely updates their rates. Accurate cost estimation becomes near impossible and procurement of adequate funds more difficult.

SORUP mentioned that the local government can also withhold permission for access to the water source from a community. In one example, the VDC did not allow the community to use a water source because the community was in the neighboring municipality while the water source was within the VDC.

Local government also needs to have policy established from the central level in order to fully push forward with MUS implementation, yet local government feels that central-level officials do not take their needs seriously.

### Government Organization (Local Line Agency) Barriers

The major impediment mentioned for line agencies at the local level was lack of technical manpower. DADO-Kaski stated that there was no provision of engineers and technicians in DADO offices and no technical knowledge for operation and maintenance on MUS. In order to build a MUS system, DADO would need an overseer, yet no overseer was available in his area, and the district and central audits made it difficult to hire an overseer from another area.

The Kaski DADO also mentioned that he does not have a budget for hybrid tapstands but only piping, so the components of the MUS systems he can support is limited. The Western Region Subdivisional Irrigation Office

Chief Divisional Engineer of the DoI referenced the same problem in saying that they are allowed to build an irrigation canal and reservoir tank but do not have provision for a piped distribution system, limiting the elements of MUS they can support.

NITP further described the lack of sufficient money for field staff travel, daily allowances, and fuel. Their small budgets must be stretched to cover all communities they work with, limiting the number of village meetings that can be attended, and making the staff reluctant to do projects that require frequent village visits. Budget constraints for field level work are aggravated by the tension between district-level irrigation departments and NGOs. The government conception is that NGOs have been receiving a lot of money without transparency in its use, creating discord between the NGOs, communities and GOs. GOs are worried about being tarnished by this reputation and are also jealous of the money that NGO staff have access to. Although the government has a larger pot of money, it is much more difficult for them to spend it, and implementing staff at the local level only receive a very small amount to spend on their work.

### National-Level Government Barriers

Respondents repeatedly cited the need for policy at the central level as the primary government barrier to MUS upscaling. DoI makes policy only for irrigation whereas DWSS makes policy only for drinking water projects, etc. To give priority for MUS and allow for the necessary mechanisms, it would need to be specifically mentioned in the planning documents of multiple agencies. NGOs, local-level government officials and local line agencies all mentioned that even though they were the implementers, it was necessary for the central government to enable MUS activity by creating specific MUS policy and providing appropriate funding. NITP more specifically suggested that although each department has their own regulations, general water supply and irrigation regulation both fall within the Water Resources Act, which could be changed to reflect an emphasis on MUS.

Interviewees also often revealed an overall lack of funding for new programs in their budgets. For example, the Deputy Director General of the DoA Planning Division said that there simply was not enough money available in their budget currently for wide-scale MUS implementation. However, this was counteracted in other statements by some that building MUS would actually be cheaper on the whole for government (although not the department implementing) because it would be multiple uses from one distribution system instead of multiple distribution systems.

And, even at the national level, the problem of sectoral funding arose. NITP said that they were satisfied with irrigation-plus systems and would promote irrigation-dominated water supply projects because they were not allowed to construct drinking water supply projects from their funding.

Likewise DWSS-CBWSSP is not allowed to supply irrigation water with their systems and said it is difficult to mobilize and coordinate resources between departments. The Fund Board also mentioned that DoI and DoA can only provide irrigation pipe and that they were only allowed to provide materials for drinking water systems. On top of this, and as mentioned before, coordination between ministries is very difficult. Some went on to say that having all agencies working on MUS would be inefficient because it would overlap responsibilities.

The Fund Board saw two different perspectives in development—macro and micro. Although they mentioned that the two needed to be harmonized to some extent, they noted that the national-level policymakers think on a macro scale: large projects at the national level. Their view was that a holistic approach such as MUS would never work on a bigger level, but only with small-scale local projects, which national government officials are not as cognizant of.

Overall, individuals felt that garnering true support at the ministry level would be the most difficult. While influencing policy-making at the national level is fairly straightforward, actual implementation of the policies is much more difficult to affect. CEAPRED mentioned that superficially all would support MUS. However, the likelihood of conflict over resource allocation remains high. The lack of sufficient political will at the central level to enforce policies such as those that would support MUS was brought up by several individuals. Follow-through generally only happens when a central-level official promises action while in a village.

## POTENTIAL FOR SCALEUP OF PROJECT IMPLEMENTATION

### Government Role—a "Home" for MUS?

While everyone interviewed agreed that MUS should be scaled up, there was certainly no agreement on how this should be accomplished. A great deal of discussion, particularly in the district workshops, revolved around whether there should be a "home" in the government for MUS, and if so, who was best suited to provide it. Most agreed that future sustainability was contingent on embedding MUS within government because of NGO and funding-source transience. Additionally, there was an overriding feeling that the government should provide water services to its citizens.

***DoI vs. DoA Debate*** Several interviewees felt that either the DoI (specifically NITP) or the DoA should be the "home" for scaling up MUS. Even the two agencies themselves were undecided about the best course of action. An internal debate within the NITP raised the fact that the DoI had some small irrigation projects that were transferred to the DoA to complete, and that MUS projects could fit within this existing implementation structure.

However, they also recognized their superior technical manpower; the DoA does not have the appropriate technical staff as was echoed by the DADO in Kaski. Ultimately, NITP decided that no specific home was necessary and the MUS could be a coordinated effort between DoI and DoA.

Differing opinions were seen within the DoA as well. The Deputy Director General of the DoA Planning Division felt that the DoI should be the lead agency but coordinate closely with the DoA. Since the DoI and DoA have pre-existing joint committees at both central and local levels that meet once every trimester to discuss common issues and joint projects, he felt that MUS should be wrapped within this structure. On the other hand, the M&E Chief of DoA said that the DoA and DWSS should jointly run MUS. His logic was that the two departments already provide community water services, so they are more adept at working directly with VDCs. Further, the DoA provides support to farmer groups at the community level. This existing mechanism could be used to scale up MUS. The DWSS also has user groups at the community level, albeit for larger-scale projects. Although the DoA and DWSS have never had a joint project, he thought that if policy were created first to mandate coordination between the two departments, then it would come to fruition.

Even if one agency was recommended as the driver, most agreed that it would take a coordinated effort because of the nature of MUS. Winrock explained that on some levels the DoA structure is easier for NGOs to work with, allowing for greater NGO coordination as well. Additionally, DoA has a field office and staff in every district, while DoI does not have this kind of institutional infrastructure. Yet DoI has a great deal of resources to support irrigation work. A strategic partnership could be built where DoI provides funding and DoA gives technical support for projects. Unfortunately, this type of structure leaves out the drinking water component. CEAPRED recognized the need for stronger drinking water support and recommended that DoI lead the MUS effort but coordinate with NGOs, the Fund Board, and the Poverty Alleviation Fund (PAF)[3].

***DDC Should Be "Home"*** Although the support of the line agencies as facilitators was considered important by most, having the "home" for MUS at the district level became the primary mechanism supported. Less surprising, it was also the consensus of those attending the district-level workshops that DDC lead the MUS effort. Both the DWSS-CBWSSP Project Manager and the Regional Agricultural Director at the Kaski LA workshop claimed that to ensure system sustainability, the DDC should be in charge. They also pointed out that setting MUS work within the purview of the DDCs fits well with the current decentralization effort in Nepal that was initiated after the 1990 uprising and opening up of the multiparty system. District line-agency offices were established in addition to the preexisting regional ones. The Ministry of Local Development also appointed Local Development Officers to run the DDC and district budget, which was further formalized with the Local Self Governance Act of 1999.[4]

Perhaps the most strongly in favor of placing control of MUS with the DDC was the Deputy Director General of DoLIDAR[5] who sees the DDC as the focal point responsible for all rural development. He feels that the closer to the community the program operates, the better services it can deliver and that as the agency with oversight of small-scale rural projects, DoLIDAR was the key agency to push MUS forward. He felt that the main issue was not completing construction of projects, but making them sustainable in the long term. Sustainability could not occur without DDC ownership. This sentiment was repeated by many at the Kaski LA workshop.

Helvetas-Palpa thought that the VDC as well as the DDC should be in charge of MUS for each specific area because they deal directly with communities and have a small amount of resources. IWMI-Nepal agreed with Helvetas-Palpa but took it one step further: the central government should direct MUS work through policy and resource allocation, and the DDCs and VDCs should make MUS part of their development activities. Considering that several MUS systems built to date incorporated deteriorating DDC drinking water systems into the new structure, DDC should incorporate MUS into their water resource development work to prevent the need for future adjustments.

Attendees of the Kaski LA workshop broke out into groups and outlined the various roles that each stakeholder should have in future MUS system scaleup. The results of these discussions can be seen in Table 7.2. At the workshop, the discussion centered on the need for DDC and VDC to assume primary responsibility for MUS with GOs, NGOs and INGOs providing support.

Attendees of the Palpa LA workshop went one step further and designed a protocol for future MUS implementation and scaleup (Figure 7.4). They, too, saw the DDC as the lead umbrella organization that would respond to demand for MUS from the VDCs, pressure central government for adherent policy, and coordinate between line agencies for planning at the district level. NGOs and INGOs would facilitate the government operation, and the media would be responsible for awareness creation of MUS technologies and success stories. They did not, however, discuss the role of the communities themselves, as in Kaski. The roles of the various organizations they outlined at the workshop can be seen in Table 7.3. There is a good deal of overlap with the Kaski LA workshop suggestions, although the roles envisioned at the Palpa LA workshop were not as comprehensive.

**Table 7.2: Role of various organizations developed at Kaski LA workshop**

| Government organizations | DDC/VDC[6] | Communities | NGOs/INGOs |
|---|---|---|---|
| • Technical backstopping<br>• Policy formulation<br>• Protocol for MUS implementation<br>• Information dissemination<br>• Program budgeting and planning<br>• Supervision/ monitoring and evaluation<br>• Coordination/ linkage between all three levels<br>• Identification of potential areas<br>• Exposure visits required for staff<br>• Share about MUS projects with other countries through workshops, visits, seminars, international visits | • Facilitation through annual planning workshop<br>• Coordination with all stakeholders<br>• Matching fund<br>• Capacity building—should work as human resource development organization for VDC level | • Scheme ownership<br>• Active participation<br>• Unskilled labor<br>• Acquisition of local materials<br>• Express all water use needs to other stakeholders<br>• Lobby DDC and VDC for MUS<br>• Information sharing<br>• Information during field visits<br>• Farmer-to-farmer exposure visits<br>• Leader farmers conduct trainings in their VDC<br>• Management of the MUS systems including distribution rule agreement<br>• Operation and maintenance of system | • Potential area/ community identification<br>• Information dissemination<br>• Resource identification<br>• Financing<br>• Technical expertise<br>• Mobilize community<br>• Facilitate market linkages and supply chain from input to end product<br>• Operation and maintenance training<br>• Organizational development<br>• Monitor community progress |

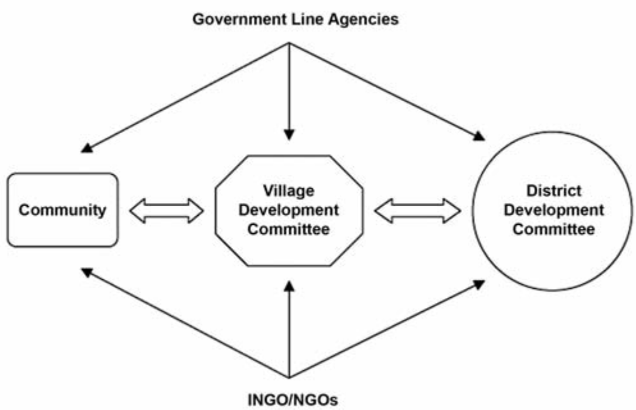
They proposed the following procedure (shown graphically in Figure 7.4):

- Community approaches the VDC for MUS during the VDC planning session
- VDC allocates money for MUS and lobbies DDC for allocation of matching funds
- DDC creates pressure to central-level line agencies for policy making to promote MUS and coordinate strong linkages between line agencies during the planning period. Line agencies included were the District Forest Office, Divisional Irrigation Office, DADO, and Women Development Office.[7]

**Table 7.3: Roles of various organizations developed at Palpa LA workshop**

| Government organizations | DDC/VDC | NGOs/INGOs |
|---|---|---|
| • Coordination between government offices<br>• Capacity building for technical staff<br>• Awareness creation for technology<br>• Technical input provider<br>• Policy formulation | • District-level coordination<br>• Facilitator<br>• Monitoring and evaluation of MUS<br>• Documentation of water sources<br>• District-level developent activities | • Social mobilization<br>• Awareness creation at community level<br>• Exposure and information provider<br>• Linkage development with line agencies<br>• Advocacy of technology<br>• Coordination between NGOs<br>• Capacity building |

**Figure 7.4 Scale-up protocol created in the Palpa LA Workshop**




Courtesy of Kailash Sharma.

***No "Home" Necessary—Coordinated Effort Required*** Some saw the need for a coordinating committee instead of one lead agency or department. The Fund Board mentioned that different departments have different targets to meet according to their specific budgets, so unless coordination occurs at the ministry level, a holistic MUS approach would not move forward. Yet different opinions on who should be included in the coordinating committee emerged. NFIWUAN felt that the coordinating committee should consist of them, DoI, DADO, and IDE. This team would jointly be responsible for supervision, monitoring, and follow-up. He said that the government and IDE should provide the "hardware" portion (the technical backstopping) and NFIWUAN the "software" part (the social development and mobilization). The NITP Coordinator thought that the coordinating team should include DoI, DoA, DoLIDAR[8], and the Department of Women Development. SAP-PROS envisaged another type of coordination where a semi-governmental body would be created with funding from the government and independent donors and implementation done by INGOs, local NGOs, and communities.

Several others felt that NGOs (and specifically SIMI NGOs) should continue taking the lead on MUS for the foreseeable future and simply coordinate with line agencies and local NGOs (much like the current system of operation). World Vision believed that the international reach of INGOs would allow for information and technology transfer between countries. DADO thought that NGOs should lead but that DoI, DWSS, and DoA should incorporate MUS into their current piped water supply schemes.

NEWAH's vision of coordination was perhaps the most all-encompassing. Line agencies at the national level would incorporate MUS into policy. At the local level, communities would demand the VDCs and DDCs allocate funding for MUS. NGOs would advocate for incorporation of MUS into projects of other NGOs/INGOs and convince donors that MUS is a worthwhile technique.

## Potential Funding Mechanisms

Most interviewees thought that NGO funding was temporary. Government resource allocation for MUS is the only economically sustainable way to scale up MUS. Helvetas-Palpa felt that communities should build their own systems with supplementary support from the VDC and DDC. The DDC is currently responsible for funding irrigation projects of 25 ha or less in the hills and 200 ha or less in the Terai and drinking water projects for populations of less than 1,000. The DWSS-CBWSSP suggested the creation of an additional fund within the DDC into which NGOs, PAF, and other donors could contribute. The DDC would then be responsible for all project management. SAPPROS, on the other hand, felt that a separate semigovernmental body should be created with its own fund for MUS.

### TACTICS FOR SCALEUP OF INFORMATION DISSEMINATION

For major upscaling of MUS, increased awareness at all levels was considered a critical component. In order to accomplish this, promotional materials should target government organizations, nongovernment organizations, and beneficiaries. To raise VDC, DDC, and community awareness, outreach efforts at the district level would be necessary. Other information-dissemination methods suggested were:

- Publicity materials—newsletter, brochure—placed in the markets
- Radio—seen as the most potent outreach medium in Nepal because of its affordability
- TV and film
- DADO has a national network through which they can disseminate information
- Build one pilot project in every district and have exposure visits
- More district workshops and seminars—have MUS beneficiaries share their experiences
- DDCs sometimes organize development forums to share best practices
- Helvetas sometimes organizes review meetings for sharing of best practices
- Could expand the World Vision farmer forum concept to other districts
- Have an orientation on MUS in each DDC and hand out booklets
- E-mail updates to network of partners on progress of MUS

## OUTCOMES

On the whole, there is currently more organizational buy-in at the local level than at the national level, at least in the districts where SIMI operates. Through the search for matching funds and partners, organizations become involved in implementation of MUS projects. This involvement concretizes their conceptualization of MUS, shows them its benefits firsthand, and increases their interest in becoming MUS advocates. What could be occurring is the phenomenon of cognitive dissonance which describes the effect of people becoming so invested in a project and their contribution to it that they become less inclined to criticize the project and more inclined to speak favorably of it.[9]

However, even those who are not involved in implementation, but have visited MUS sites, have little negative feedback.

## BUY-IN AT THE COMMUNITY LEVEL

In meetings with both SM/CM and AT/IT/MS/DM SIMI staff, they claimed that their major hurdle is greater demand for MUS systems than SIMI can handle. Most partners (World Vision, CEAPRED, SAPPROS, SORUP, DADO, NITP, etc.) reported that since becoming involved in the building of MUS projects, they have received continual requests from neighboring communities. The NITP Coordinator gave an example of the Lele project in Lalitpur District that they are contributing funding to. Three to four communities in the vicinity of Lele have already requested MUS. And they are getting requests from other districts as well—too many to count. The NITP Coordinator had noticed that in districts where NITP contributed to building a MUS project, there were always requests for additional MUS funds from district staff the following year. This shows that once systems are built in a district, demand for MUS is generated. And, community-level buy-in is not a problem for future MUS scaleup.

In fact, community buy-in is an essential component of MUS projects. Communities are willing to contribute substantial resources toward MUS systems. Not only do they provide labor and local materials as a group, but each household purchases a microirrigation system with its own money. In 44 of the 81 MUS schemes built to date, the communities have actually contributed cash to their systems as well. As shown in Figure 7.5, communities have contributed 16 percent of the total cash spent on all MUS schemes through 2008.[10] Purchases of microirrigation kits are considered separate from and in addition to project costs. And project costs shown here do not include IDE-Nepal/WI overhead costs. See chapter 2 for more information on the average project costs including overhead.

## BUY-IN AT THE DISTRICT LEVEL

### Funding Support

Because of the practical advocacy conducted to secure financial partnerships, the major outcome of the LA was funding support. Over the period of MUS-system construction to date (2003–2008), government funding has continually increased. This shows the success of the matching-fund effort and the perception that MUS is worth supporting. The proportion of cash contribution from each stakeholder throughout the five-year period is shown in Figure 7.5. Total government contribution of schemes to date is 22 percent of all cash costs. The major government organizations that have contributed are DoI/NITP and DoA (through DADO). DWSS and the District Soil Conservation Office have also contributed to a few projects. Funding from the local government structures (VDC and DDC) comprise the remaining portion of government support. Other INGOs (World Vision, CARE Nepal, and Helvetas-LIPS), local NGOs (local/regional clubs and schools), and the communities themselves have all contributed cash for MUS projects. The communities also were responsible for contributing all unskilled labor and local materials that went into project construction. When noncash costs are factored in, community contribution totals 47 percent of all project costs as shown in Table 7.4 and Figure 7.6.

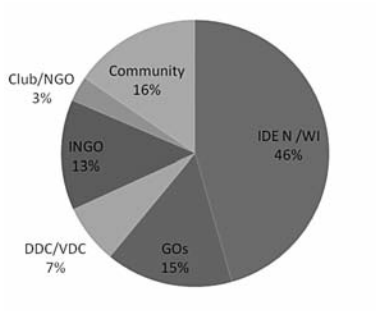
**Table 7.4: Percentage overall contribution by various stakeholders to the total cost of all IDE-Nepal/WI MUS schemes built, 2003–2008**

| Organization | | Total amount (NPR) | Total amount (US$) | Percent |
|---|---|---|---|---|
| NGO's | IDE-N/WI | 4,550,244 | 65,003 | 28 |
| | INGO | 1,332,676 | 19,038 | 8 |
| | Local NGO | 308,546 | 4,408 | 2 |
| | Subtotal | 6,191,466 | 88,449 | 38 |
| Government | Government Organizations | 1,537,927 | 21,970 | 10 |
| | DDC/VDC | 719,040 | 10,272 | 4 |
| | Subtotal | 2,256,967 | 32,242 | 14 |
| Community | Cash | 1,539,581 | 21,994 | 10 |
| | Non Cash | 6,216,037 | 88,801 | 38 |
| | Subtotal | 7,755,618 | 110,795 | 48 |
| Total | | 16,204,050 | 231,486 | 100 |

Note: Noncash contributions are all provided by the community and include unskilled labor and local materials like sand, stone, and gravel. Noncash items are calculated on local prices and labor rates. Source: IDE/WI scheme data.

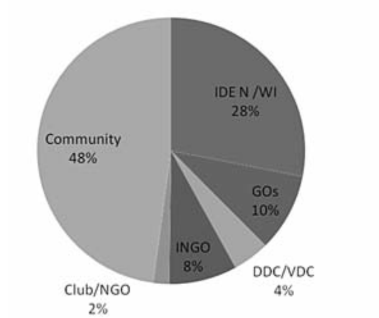
Perhaps the most positive outcome of the LA in Nepal has been the inclusion of MUS in the DDC guidelines for VDC funds. Through activity on the SIMI advisory committee, the Ministry for Local Development has been involved in MUS development over the past four years. Due to the positive response to the approach, the Ministry has recently included MUS in their fund allocation guidelines. These guidelines comprise a list of what the central gov-

**Figure 7.5 Percentage cash contribution by various stakeholders to the total cash cost of all IDE-Nepal/WI MUS schemes built from 2003-2008**




Note: Community cash costs do not include purchase of microirrigation kits. Those are considered separate purchases from the MUS system. IDE-Nepal/WI costs do not include overhead costs.
Source: IDE-Nepal/WI scheme data.

**Figure 7.6 Percentage contribution (cash and non-cash) by various stakeholders to the total cost of all IDE-Nepal/WI MUS schemes built from 2003-2008**




Note: Community cash costs do not include purchase of microirrigation kits. Those are considered separate purchases from the MUS system. IDE-Nepal/WI costs do not include overhead costs.
Source: IDE-Nepal/WI scheme data.

ernment considers "useful" development work for the DDC to undertake. In other words, MUS is now an official development activity in Nepal. DDCs receive federal funding for development activities. Through the explicit addition of MUS in the guidelines, the DDCs are now authorized to provide VDCs with funds for MUS projects. This action of the Ministry for Local Development will allow communities to leverage local funds for MUS cash costs. It also shows that LA and MUS-implementation activities in Nepal have generated enough awareness about MUS that the approach is beginning to be inserted in policies and procedures.

## Promises Given at Workshops

LA workshops were incredibly successful at attaining public declarations of support for MUS. At the Kaski LA workshop, the Regional Agriculture Director, who is responsible for 16 districts, said he would suggest to all his district-level staff to incorporate MUS wherever possible in their work. He promised to request that his project staff in each district meet with SIMI and other NGOs to coordinate MUS implementation. The Local Development Officer (the head of the DDC) declared at the Kaski LA workshop that he would organize a water resource development workshop for the district. He requested organizations coordinate with the DDC on MUS work during their planning period. NITP also announced that they are increasing their MUS-project area coverage and arranging for more publicity about MUS throughout Nepal.

The Palpa LA workshop was even more successful for garnering funding pledges and support. At the workshop, the Western Region Subdivisional Irrigation Office Chief Divisional Engineer said that after the workshop he was ready to allocate NPR 50,000 ($714) per scheme for three MUS schemes in Palpa over the coming year. He mentioned that a major benefit of the workshop timing was that it coincided with his office's planning period, so he had more flexibility in allocating resources for MUS. This promise was a major step forward: it was the first time that a DoI divisional office promised financial assistance for MUS. Prior, all DoI funding had come through NITP at the national level. The Palpa Local Development Officer was unable to attend the workshop, despite previously juggling his schedule in order to make it. However, he assured his support for MUS in the future—through financing, policy/regulation, water source documentation, etc.

The second major development at the Palpa LA workshop was the increased interest of the Ministry of Forest and Soil Conservation. Although a couple of projects in Surkhet and Syangja had received funding from their District Soil Conservation Offices, the one in Palpa had not yet contributed to MUS. The Chief District Soil Conservation Officer of Palpa stated at the workshop that he would try to incorporate MUS into their future projects. Not only does their policy support tank construction, but their office has provisions for making them. The construction of tanks could be a perfect fit for their contribution toward future MUS projects. Additionally, the Chief District Forest Officer claimed that he would certify any future MUS projects that required use of water sources on land that belonged to the Forest Department. He said that he saw the potential synergy between his department and MUS because communities would be more likely to protect their forests if they depended on and managed the water resources in them.

Lastly, the Palpa LA workshop renewed the interest of a previous MUS partner, Helvetas-LISP. Although they had partnered on a few of the beginning MUS projects, a phase of budget planning had prevented them from contributing funding in recent years. After the workshop, they expressed excitement about rejuvenating the MUS partnership with SIMI.

The Joint National/Lalitpur District workshop held on July 2, 2007, also resulted in important steps forward for MUS. This workshop was successful in creating new partnerships of interested organizations including Water Aid, Practical Action, Capacity Building for Gender Equality, Empowerment of Women (a project of the Department of Women Development), and Manohari Development Institute.[11] After the workshop, Manohari Development Institute decided to build 60 MUS systems in Makwanpur District with technical support from SIMI. The Department of Women Development stated their interest in investing in MUS systems from their infrastructure budget. Water Aid requested to see MUS design layouts and discussed future joint implementation with SIMI staff. DoLIDAR requested a one-day MUS training for their technical staff. DWSS-CBWSSP and the Federation of Water and Sanitation Association of Nepal both indicated interest in future collaboration. SIMI is planning bilateral meetings with each of these organizations.

### Partner Organizations Implementing Their Own MUS Projects

A few partner organizations also mentioned that they were constructing their own MUS projects. Two NGO partners said that they already used the MUS approach, although when explained, the projects turned out to be more domestic-plus than MUS-by-design (see Van Koppen et al. 2006 for discussion on these terms). SAPPROS has been working with communities on drinking water systems for the past ten years and provide additional water for irrigation in their systems. They said that involvement in the LA has raised their awareness of the possibilities of MUS-by-design. They are now linking microhydro systems with irrigation in two districts they work in. NEWAH designs their drinking water systems to include livestock (45 liters/capita/day for both domestic use and livestock) plus an additional 20 percent delivery for a 20-year projected population. They encourage the communities they work with to use this 20 percent extra plus domestic wastewater for kitchen gardens. NEWAH mentioned that the communities they work in always ask for irrigation pipes in addition to their drinking water scheme. They do not provide the community with extra pipes to use system water for irrigation but encourage them to purchase and install the pipes on their own. Since LA involvement, however, NEWAH is interested in MUS-by-design. If IDE incorporates a stronger sanitation component, they wish to partner on future MUS systems.

Government agencies have also built a few of their own MUS schemes with SIMI providing technical support. The DADO in Tanahun District has constructed their own projects with IDE technical support. NITP has built projects in Palpa, Surkhet, and Kavre districts. And although they have not implemented their own projects, one of IDE's local partners in Doti District wrote an article about MUS that was featured in the journal *Society of Public Health Engineers* in March 2007.

## BUY-IN AT THE NATIONAL LEVEL

### NITP Projects Funded by the Asian Development Bank

When the Asian Development Bank (ADB) was planning their current loan project, they wanted to encourage microirrigation work within the DoI. Although the ADB Nepal Resident Mission had attempted to work on microirrigation before, they had been largely unsuccessful because of the political conflict. However, through an ADB-affiliated planning consultant, they heard that IDE had been able to work on microirrigation during conflict periods. Subsequently, the ADB South Asia Regional Director approached the Head Engineer of IDE to discuss IDE's work. They requested IDE to write a joint proposal with DoI for microirrigation. IDE incorporated MUS in the proposal. Once the project was accepted, the Head Engineer of IDE was offered the Technical Assistance Team Leader position for the project by ADB. While this left a vacuum within IDE on LA efforts during the transition period to a new Head Engineer, it propelled MUS forward within NITP and the ADB and established a project specifically designed to create a plan for scaleup.

Livelihoods Enhancement through Microirrigation (LEMI) was a one-and-a-half-year $450,000 pilot project with DoI as the executing agency. The NITP Coordinator was the Technical Assistance Team Leader for the project. Through the LEMI project, the NITP made a comprehensive policy and "implementation modality" for MUS and microirrigation projects. A broad microirrigation project was pilot tested in each of the five districts through an NGO consortium. IDE was the team leader with Winrock, SAPPROS, and independent consultants forming the remainder of the implementation team. As part of these five larger projects, six MUS-by-design projects were built in four of the districts. The remaining projects sold microirrigation kits to farmers who had water availability above 100 liters per day for kit operation. These farmers are using the existing domestic systems as a water source. Therefore, they are de facto MUS projects, but not MUS-by-design.

LEMI management involved the use of Sub-project Management Units for each of the five districts. The Sub-project Management Unit was chaired by the irrigation chief of that district with a representative from the DoA; DWSS; Department of Women, Children, and Social Welfare; DoLIDAR; the Nepal Agricultural Research Council; DDC; and one local NGO. A Sub-project Management Unit with the same structure at the central level oversaw the whole project. This structure was essential to the sharing of the MUS approach across the relevant departments at the central level. The NITP coordinator claimed that coordination at the central level had been smooth thus far. However, the district-level Sub-management Units functioned less effectively, largely due to a lack of active participation by representatives from other line agencies. Conversely, the LEMI Team Leader claimed that the district-level representatives for the Department of Women, Children, and Social Welfare were much more actively involved than the central-level representative. This department played an important role in the Sub-project Management Unit because they assist a large number of district women's groups involved in development activities such as savings and credit, income generation, vegetable production, etc. Realizing the importance of women's involvement in water resource development projects, these groups are an existing structure that LEMI is tapping into for implementation.

Farmers involved in the de facto MUS portion of the LEMI project complained that they faced dry-season water shortage and did not have an adequate supply for microirrigation. Therefore, one of the overall recommendations that emerged from LEMI was the necessity of MUS for upscaling microirrigation. And, according to the NITP coordinator, NITP plans to scale up MUS, starting with 50 new MUS systems in Hetauda in Makwanpur District (for which IDE is providing technical assistance). Current NITP funding of MUS projects is at 40 percent contribution. However, they are willing to fund up to 75 percent of the cost of projects in the future with 25 percent contribution from the community.

## NITP Work in General—Shift in DoI Thinking

The greatest support for MUS at the central level has come from NITP. At the beginning of the MUS project, DoI would only providing funding for MUS if they were called "microirrigation schemes." Now, they are much more open about supporting MUS. For example, recently the DoI held an Irrigation Day to discuss irrigation issues at the national level and invited the Water Resource Ministry, Water Energy Commission Secretariat, and other high level officials of various departments. The NITP Coordinator was requested to give a presentation on the Lele MUS scheme that was very well received.

The internal shift within the DoI has been substantial. The NITP Coordinator described the situation a few years back when NITP was established: almost the entire department resisted smaller-scale projects and even at the field level NITP had difficulty motivating staff to work on small projects. But, in only a few years that mindset has drastically changed: now only about a quarter of DoI staff still believe that small-scale projects are not worth their time. DoI engineers and overseers are motivated to work on small-scale projects because they see the direct benefits of their work for communities. With only a small amount of financial resources and a short time frame (a few months) they can receive a huge return on their investment. They are receiving such positive feedback from communities, NGO partners, national-level GOs and international visitors that it not only improves their external relationships, but also reflects positively on them and their work. Similarly, regional directors within DoI were initially negative about NITP and refused to implement small projects, but are starting to comment that small projects have some benefit. Although many still perceive a greater value in large projects, they now see the worth in small projects as well.

## International Aid Agency Projects

In 2007 the Finnish International Development Agency (FINNIDA) began a development project called "Rural Village Water Resource Management Project" (RVWRMP) implemented through joint collaboration of the government of Nepal and Finland with a major MUS component. Its focus is on working through the local government bodies (DDC and VDC) in far western and mid-western districts (see Plate 1) to encompass all possibilities for water resource management. The project is in the preliminary phase, preparing Water Use Master Plans. The RVWRMP MUS work is incorporating picohydro or microhydro power in addition to domestic and microirrigation uses to help broaden the conceptualization of MUS in Nepal. The funding of the project breaks down according to Table 7.5. IDE-Nepal has signed a Memorandum of Understanding to be the livelihoods advisor to these MUS projects.

**Table 7.5: Funding contributions for RVWRMP project**

| Organization | | Percent Contribution of RVWRMP Project |
|---|---|---|
| Government of Finland | | 82.6 |
| Central government of Nepal | | 7.0 |
| DDC | | 1.0 |
| VDC | | 1.0 |
| Subtotal | | 91.6 |
| Community | Cash | 0.2 |
| | Non Cash | 8.2 |
| Subtotal | | 8.4 |

Source: IDE-Nepal RVWRMP project data.

The Japan International Cooperation Agency is also planning to fund some MUS projects in Nepal. They have signed a Memorandum of Understanding with IDE-Nepal to implement these MUS systems within the SIMI project area of Lalitpur District.

### Poverty Alleviation Fund (PAF)

The PAF has shown some interest in MUS. As a semi-autonomous government body, they have substantial resources. IDE has given a presentation to them about MUS and is developing a Memorandum of Understanding at the central level for training of district advisors. These district advisors will in turn train district NGOs.

### World Bank Interest

The Fund Board (discussed in chapter 1) is a World Bank supported program that provides rural water supply and sanitation services. While the Fund Board is interested in microirrigation, it has not yet fully accepted the MUS concept. A few years back the Fund Board was interested in incorporating microirrigation into their water supply schemes. They heard about the success of MUS pilot projects and proposed five joint pilot MUS projects in Palpa where they would supply the drinking water component and IDE would supply the irrigation component. However, when the Fund Board brought this proposal to the World Bank, concerns were expressed that domestic water priority would be subverted for irrigation, and the proposal was stalled. Recent conversations have led to renewed interest, particularly in incorporating MUS as part of an upcoming $50 million irrigation and water management project for western Nepal. Bilateral conversations are ongoing.

## CONCLUSIONS AND LESSONS

There are many important lessons to be gleaned from the Nepal LA experience. Some are specific to the situation in Nepal, but have implications for the propagation of MUS worldwide.

### FULFILLING COMMUNITY NEEDS

One simple, important lesson from MUS in Nepal is that a scheme or technology will fail if it cannot meet community needs. Yet, if their needs are met, community members become advocates for the concept. This became apparent during a conversation with a WUC chairwoman at the Palpa LA workshop. She told the story of her village's history with SIMI and MUS. At first, IDE had worked with the community to purchase and install microirrigation systems for vegetable production without developing the water source, as was the original IDE design. When the IDE project with the village phased out, they stopped producing vegetables or using their microirrigation kits because they had a lack of sufficient water. Instead, they were using the drip header tanks to reserve water for toilet use. They eventually went back to SIMI after hearing of their MUS work, and requested that SIMI help them with a MUS system. They worked out an agreement with a nearby community to allow use of a portion of their water supply, and SIMI built a MUS scheme in their village. Now they are not only regularly using the MUS system and microirrigation kits, but are also promoting MUS to other communities in the district. And, because of their efforts, two more systems have been demanded from neighboring communities. This shows that although SIMI was addressing peripheral needs at the onset, the true need for greater water supply was not being met. Thus, microirrigation efforts were not as successful as anticipated. However, once the full needs of the community were met, they became advocates for SIMI, MUS, and microirrigation technology.

### RAISING COMMUNITY CAPACITY

Although improving the community's technical skills is a stated objective of MUS projects, their capacity is being raised in other aspects as well. According to IWMI-Nepal, MUS has become a major medium for social integration, networking and the creation of relationships for water sharing. And, as the community members begin making more income through vegetable production, they often pull money together for other development work in their village. Furthermore, by requiring formal source use rights, communities must negotiate with their neighbors and determine water use and allocation at a crucial time when water is becoming a more sought-after resource. By having all members part of the allocation process, disputes over water within the community are diminished. As DADO-Kaski put it, "MUS helps to maintain the social harmony."

Through the search for matching funds communities are learning to advocate for themselves to other NGOs and GOs. This not only helps communities satisfy all of their water resource and other development needs, but inadvertently leads to MUS dissemination and information transfer. According to Helvetas-Palpa, MUS communities are now demanding more services. And, as the SIMI Team Leader noted, the marketing committees that were set up as part of the SIMI projects have been another lobbying tool for MUS.

## SEEING IS BELIEVING

Perhaps the single most important lesson from the MUS LA in Nepal is that "seeing is believing." Those who maintain reservations about MUS, like the Fund Board, have never seen a MUS system; those who have seen MUS systems, like national-level NITP and DoA staff, are already advocates of the approach and interested in working toward scaleup. As the NITP Coordinator said, "When people go to the projects they are impressed, so it makes NITP look good." Even the DoI Director General was very impressed after seeing a few MUS projects, making a request for increased NITP funding easier. It follows that constructing pilot MUS systems prior to an attempt to spread the concept is important. It may also be one explanation for stronger district-level buy-in.

To this end, the importance of exposure visits cannot be understated. For example, the DADO officer said that many visitors request field visits to MUS projects. As a MUS partner, he goes with them. He said that each time he attends a field visit he gets a greater understanding of and interest in MUS. All interviewees mentioned the need to have more of them for MUS scaleup. Some even encouraged the construction of pilot projects in every district across the country to provide an example for the DDCs and VDCs. And, with most stakeholders pointing towards the DDC as the vehicle for scaleup, exposure visits take on even more relevance. Furthermore, exposure visits are important for community interest. The NITP Coordinator stated that without a physical system, it is difficult to explain to a community how the technology can benefit them, but once there is one scheme to show them, it becomes much easier to establish more projects in the area.

## ESSENTIAL LINKAGES

### SIMI

Attaching MUS to SIMI implementation (which was later followed by implementation through both the Ujyalo and BDS Maps projects in a similar fashion) was fundamental to the success of MUS in Nepal. SIMI provided a larger project framework that made the essential linkages with microirrigation technology, vegetable production, and connection to markets. These program linkages led to system pay-back through vegetable production and the ability of households to afford operation and maintenance funds. It also was crucial in raising the status of women in these communities (reference chapters 4 and 6), a major component of successful systems.

More specifically to the LA, the SIMI Advisory Board was vital to national-level buy-in. It is officially recognized with the government and has representation from the Ministry of Agriculture and Cooperatives; Ministry of Finance; Ministry of Women, Children & Social Welfare; Ministry of Local Development (within which DoLIDAR is housed); DoA; DoI-NITP; National Agriculture Research Council; Agro Enterprise Centre; SAPPROS; CEAPRED; IDE-Nepal and Winrock International. The NITP Coordinator and Director General of the DoA Planning Division are both members of the board, increasing their interest in the program and keeping them intricately involved in project progression. Minutes from the board meetings form guidelines for district action. Therefore, if something is decided at a meeting, it becomes a directive that district line agencies must follow, giving weight to board meetings and discussions.

## NITP Movement

While the use of SIMI as a MUS vehicle was essential to its success, perhaps even more important for the LA was the synchronicity with the nonconventional irrigation technology movement, the beginnings of NITP. The onset of the MUS project was just after the initiation of NITP, a small division made up of only a few forward thinking individuals within DoI. DoI receives the majority of its funding from ADB and the World Bank. Since both institutions have been ridiculed internationally in the past several years for funding wasteful large projects that do not help the most impoverished, they put pressure on DoI leadership to include smaller projects in its portfolio. Although the leadership of DoI preferred large-scale projects, they created NITP to placate the donors. This initially left NITP in a difficult position.

The concept of nonconventional irrigation was not popular with most of the Department so NITP searched for a way to prove its worth and garner respect from the remainder of the Department. The fledgling division expressed interest in partnering with IDE on microirrigation technology and as the relationship developed, MUS came into view. NITP was handicapped by internal policy: working on schemes with construction costs over NPR 100,000 ($1,429) required a complicated and time-consuming contract awarding process. However, NITP had free reign to provide up to that amount of funding to a project. MUS was a perfect fit because it addressed the problem of water scarcity, provided surplus water for irrigation, was linked with microirrigation technologies, and had a low investment with quick rewards.

Most NITP staff were general DoI staff assigned to work specifically on NITP. They were skeptical of NITP, leading to a lack of support within NITP for its own mandate. Yet, as the NITP engineers and other staff began to work on MUS, it had a surprising transformative effect on them. The NITP Coordinator described how MUS raised staff morale: whereas on large projects the engineers rarely saw the direct impacts of their projects, MUS was tangible, quick to construct, and brought positive results within a few months. As momentum for MUS grew within the NITP staff, word slowly spread throughout the remainder of the Department, ultimately soliciting the positive responses mentioned above.

## IMPORTANCE OF CHAMPIONS AT ALL LEVELS

Even though MUS benefited from the connection with the NITP movement, it would not have moved forward as a concept without the work of dedicated champions at all levels. There are examples at each level of individuals who were largely responsible for connecting partners, advocating for communities, and believing in the ability of MUS to achieve their goals. In NITP, both the NITP Coordinator and an engineer passionate about small-scale irrigation technologies were drivers of microirrigation and MUS. The DoA M&E Chief has been largely responsible for the sharing of the MUS approach throughout the DoA. World Vision gave credit to the Kaski DADO for recommending SIMI technologies to them for their successful MUS project with landless people in Patneri VDC. They said that he pushes them to try new technologies, and shares new ideas from other districts, which is how they came to know about SIMI and MUS. Similarly in Lalitpur, the Lele Social Mobilizer explained how the DADO was the connection between IDE and the Lele community. The community had come to him for help as a poor, lower caste community with no previous development activity in their village. He subsequently advocated for them to work with IDE on a MUS project. As explained in detail in chapter 3, it was the work of one leader farmer that shared information about the MUS concept and SIMI's work between villages in Palpa District. He successfully advocated for projects for both his own community and a neighboring one.

## LACK OF STRATEGIC APPROACH

Despite many successes of the LA and of MUS in general in Nepal, the LA approach was not perfect. Although IDE was successful in pulling together partners at the various levels and generating wide interest in MUS, they lacked an overall strategic approach to the LA. The lack of strategy for the LA, particularly at the national level, may have decreased the overall success of the effort. For example, despite several overtures to the DWSS to join the LA, they were perpetually resistant to involvement. Only recently has it come to light that the DWSS is unable to work with IDE on MUS projects. An internal policy mandates that the Department cannot work on projects serving a population under 1,000. Since all MUS projects to date are smaller, DWSS was not the best fit for MUS partnership. There are other departments within the government that are initially less obvious but do work on small-scale drinking water projects in rural areas and would have been better suited for the LA from the onset. For example, the Community Based Water Supply and Sanitation Project (CBWSSP) is an ADB funded project to be completed by 2010 that is affiliated with the DWSS but actually focuses on small communities. And, this CBWSSP has even handed over some of their schemes to DoLIDAR within the Ministry of Local Development. DoLIDAR's focus is small-scale rural infrastructure projects, including drinking water. Although the Ministry of Local Development, within which DoLIDAR falls, is a member of SIMI's Advisory Board, a direct invitation to DoLIDAR into the LA would have been a useful connection. Relationships with these organizations are now beginning.

## Partner Follow-Up

Another deficiency of the LA was sufficient follow-up with organizations that had attended national-level workshops. The interval between workshops was also too long, failing to capture the momentum generated at each meeting. Although relationships with Kathmandu University and NFIWUAN were nurtured, other partners that were not directly working on MUS projects fell by the wayside between workshops. This led to lack of actionable interest from these organizations and gaps in knowledge about what was actually happening with MUS. For example, NEWAH was at the first LA workshop, and yet during their interview was unaware that MUS was now being done in government projects and with government support. This shows the dearth of information flow with some of the LA partners. Particularly considering the feeling of some partners that the focus on the domestic water component was insufficient, relationships with partners like NEWAH could have been strengthened.

## Failure of NFIWUAN as Lead

Although SIMI worked out an agreement after the second National MUS LA Meeting for NFIWUAN to take the lead on the LA, difficulties arose. SIMI did not have enough resources for NFIWUAN's MUS work, so NFIWAUN needed to raise funds. According to SIMI staff, they had previously indicated their ability to raise matching funds but were unable to follow through. SIMI suggested working with them to prepare a budget for another LA event, but a concrete proposal was never created. Additionally, as SIMI worked with other partners, staff became aware of rumors that NFIWUAN was affiliated with a particular political party, affecting their ability to effectively coordinate multiple organizations.

When interviewed, NFIWUAN individuals expressed the opposite of what SIMI staff had relayed. They indicated that it was SIMI staff that had lagged in communicating with them. Considering that both parties felt that it was the other who had shirked responsibility, a communication gap seems the likely explanation. But more importantly, it shows the importance of having funding to back any concept promotion or project implementation. While SIMI had good experience with organizations providing partial support for projects, it had maintained the lead in project implementation. It is very difficult to request an organization to take the lead on projects without providing funds with which to do so. On the flip side, part of SIMI's experience with NFIWUAN was based on the nature of the organization itself and the hesitance of other organizations to work with one that was deemed politically biased. SIMI staff is currently working to resurrect this relationship. NFIWUAN has assured SIMI of their neutrality and is slowly rebuilding the organizational relationship. They assisted in coordinating the Joint National/Lalitpur District workshop held on July 2, 2007 and have since expressed interest in renewing their fundamental role in the LA.

Over time, SIMI staff has also come to realize that MUS systems resemble domestic water systems much more closely than irrigation canals. Therefore, FEDWASUN may have been a better LA coordinator than previously thought. Not only is FEDWASUN enthusiastic about MUS, they have been active participants in meetings and exposure visits. Ultimately, SIMI staff has realized that both NFIWUAN and FEDWASUN are necessary partners for MUS.

## PERVASIVENESS OF "BIGGER IS BETTER" CONCEPT WITHIN GOVERNMENT

Despite promising reactions from national-level government officials, there is still a large-scale project orientation within the government. IWMI-Nepal mentioned feedback at workshops from government officials claiming that MUS projects have too small of an impact. The Technical Unit Chief of SAPPROS argued this was simply lack of exposure to the idea. He said that twenty years ago he hesitated to believe in microsystems himself, but when he saw the developments in microirrigation technology, he recognized that it was time for Nepal to change. Those within DoI and DoA are predominantly interested in building big systems and are skeptical that a small amount of water can provide enough for sufficient irrigation. IWMI-Nepal elaborated by saying that central government policies do not specifically address small-scale schemes. Instead, officials at the national and even some at the district level consider microlevel projects to be the purview of local institutions. Central government attention is just beginning to enlarge to include small-scale technologies, so linkages between departments are nascent. The 2003 Irrigation Act does begin the process of small-scale irrigation technology integration, but MUS is not yet a part of the policy dialogue.

Similarly to DoI, DWSS maintains a large-scale project orientation, even within the CBWSSP, which is supposed to work on small-scale projects. This became evident during the CBWSSP interview. The interview was largely conducted with the Project Manager but he called two of his top engineers in for part of the meeting. While the author was speaking with the Project Manager in English, another SIMI staff member was speaking to the two engineers in Nepali. The Project Manager was very positive about MUS and stated that it would "uplift their [rural communities'] economic condition, personal hygiene and health" and "definitely have a good impact." At the same time, the engineers stated that MUS was too small and they only desired to work on large projects. This could have been due to the fact that like in NITP, CBWSSP staff was selected from the general pool of DWSS staff, bringing their large-scale project preference with them despite CBWSSP's mandate. Or, it could be that the Project Manager has learned the requisite response to gain favor with international visitors and does not really support small-scale projects. Regardless of the reason, the engineers' response shows the substantial room for sharing the benefits of small-scale water resource development projects with those in the Nepal government.

Furthermore, even if the government departments are just beginning to shift, the fact that they have supported large-scale projects for so long has led NGOs and other partners to doubt whether their support of small-scale projects is genuine. Most partners have the conception that these departments are still largely uninterested in small projects.

## DOMESTIC-PLUS AND IRRIGATION-PLUS

As might be expected, irrigation practitioners are much more likely to advocate for domestic-plus systems than irrigation-plus ones (although DADO is an exception). An NITP engineer suggested that in rural areas where spring water is already used for all purposes, implementers of domestic schemes should support additional uses. In essence he was advocating a domestic-plus type of system. Several others stated that as long as a source had enough water, domestic water systems should be extended to include irrigation. One exception to this was the representative from DADO-Kaski who felt that it should go both ways—all GOs working on providing irrigation water should also provide drinking water and all GOs working on providing drinking water should also provide irrigation water. During the Kaski LA workshop, his regional DoA supervisor questioned him on this and said that DoA should not be responsible for providing drinking water. The DADO-Kaski responded that the communities would end up using the water for both purposes anyway, so why not support the irrigation component of MUS projects?

On the other hand, domestic water practitioners were not nearly as likely to advocate for either domestic or irrigation plus. They were more comfortable with the traditional sectoral approach. Stated reasons for this skepticism of MUS included worry that irrigators would take too much water causing domestic supply to suffer and questions regarding the quality of drinking water provision.

## GARNERING INCREASED SUPPORT FOR SCALEUP

### Importance of Getting Funders on Board

During the Fund Board and CBWSSP interviews, it became evident that they rely heavily on the opinions of their funders—the ADB and World Bank—to guide them. The Fund Board had initially been very receptive to discussions about partnering on MUS and had started creating a plan for joint pilot projects. However, when they relayed the idea to their World Bank funders, reservations were expressed and the plan was delayed. They were largely worried about ensuring domestic supply: if domestic use was integrated with productive use, villagers could increase their production to the point where domestic water use would suffer. The Fund Board's mid-term evaluation with the World Bank is approaching. They are planning to readdress the issue and potentially visit MUS field sites. Similarly, CBWSSP expressed the necessity of achieving ADB's support before they could participate in MUS projects. DoLIDAR, while not mentioning particular funding support, did mention it as a constraint on flexibility in operations. Due to consistent funding constraints, the government will activate a particular project model if a funder comes to them with money to back it. Unfortunately, they will accept this funding regardless of whether they actually think it is the best course of action for the country. The strings attached to specific projects require government officials to accept projects in isolation. This makes coordination across government bodies more difficult. NEWAH also mentioned the boundaries placed on the organization and projects and the need for donor support to try new things. As NEWAH said, "if the donor doesn't open the gate, the implementer can't do it."

> *"If the donor doesn't open the gate, the implementer can't do it."*—NEWAH Manager, Technical Development Division

### Greater Emphasis on Drinking Water and Sanitation

Participants of both district-level LA workshops expressed the feeling that the irrigation component was superseding the domestic water component of MUS project implementation. While this was in part due to IDE's irrigation technology focus, it might also have been due to the different levels of support coming from DoI and DoA versus DWSS and the Fund Board. However, it became apparent through the LA workshops and personal interviews that the participation of more domestic water focused organizations is crucial for scaleup. And, a great deal of opportunity exists to increase involvement of organizations involved in domestic water and sanitation work. For example, NEWAH mentioned that they were interested in working with IDE on MUS. However, placing a greater priority on the sanitation component would be necessary to secure their participation.

### Workshops Key Promotional Tool

In talking with partners and attending district-level workshops, the importance of the workshops for conceptual sharing, creating new partnerships, and securing future funding became clear. All interviewees ranked workshops as the second most important tool for MUS upscaling (with exposure visits being foremost). As described above, workshops were essential for acquiring and sometimes even increasing previously promised matching fund contributions at the district level. For example, after the Regional Director of the DoA attended the first National MUS LA Workshop, he directed DADO-Kaski to support several schemes for the following year. In another example, the Machhapuchre Development Organization was planning to provide funding support of NPR 5,000 ($71) for a MUS project prior to the Kaski LA workshop, but after the workshop, they increased their funding support to NPR 30,000 ($428). Discussing the concept of MUS with other organizations and community groups created momentum for the approach and increased the likelihood of participation of each partner.

### Link with Farmers' Forum

While discussing with World Vision, they suggested using their existing farmers' forum as a tool for scaleup in the district. Although there is only one farmers' forum now, this could be an excellent way to upscale MUS information dissemination. The possibility of establishing farmer's forums in each district would institutionalize the LA at the district level and foster communication between communities, VDCs, DDCs, district line agencies, and NGOs.

### Other Suggestions

There were several other suggestions at the Kaski LA workshop on ways that each stakeholder could improve MUS operations for scaleup. These are shown in Table 7.6.

## UNCERTAIN POLITICAL SITUATION IN NEPAL

The discussion of the MUS Learning Alliance in Nepal would not be complete without mention of the political turmoil in the country and its affect. Perhaps the most striking factor of the political situation that affected the MUS LA was the situation of district government. As mentioned above, the districts have been operating for the past few years in the absence of elected representatives in both the DDC and VDC. As the Deputy Director General of DoLIDAR so aptly put it, "without local leaders, without local representation, how can you work in the community?" Without a functioning government system at

**Table 7.6: Areas of improvement for MUS scaleup**

| Government organizations | DDC/VDC | Communities | NGOs/INGO |
|---|---|---|---|
| • Fund collection from community for O&M<br>• User group trainings (government staff should be trained by NGOs first)<br>• Test drinking water in a lab<br>• Develop working modality for government MUS infrastructure<br>• Develop point of use water treatment technology<br>• At national level, develop policy for MUS implementation to encourage donors to contribute | • DDC should run a pilot project in each VDC<br>• Efforts for raised awareness within the DDC and VDCs<br>• Mobilize community to seek VDC/DDC support for MUS<br>• Incorporate NGOs and INGOs into the Development Committee[12] of the DDC<br>• Simplify process of registering water users groups | • More exposure visits<br>• Training of local manpower for O&M<br>• Provision of maintenance tools<br>• Create a fund for system operator wages<br>• Leadership training<br>• The community should manage the financial resources for their own project[13] | • Hold regular meetings of all stakeholders at the district level.<br>• Allow communities to manage all funds<br>• Get commitment from the major political parties to implement MUS<br>• Plan timing of project budgets around the government's schedule so planning periods match up<br>• Identify potential sites for MUS before government planning session |

the local level, government operations cannot run smoothly, money cannot be allocated on time, and the only recourse communities have to express their needs is contacting the one appointed VDC Secretary or DDC Local Development Officer. And, many VDCs do not even have a working Secretary. Due to this precarious government situation, NGOs have stepped in to provide community-level development. However, even though NGOs were able to work during the conflict and continue to work in under tenuous circumstances, it has definitely taken its toll on their operations.

Despite the success of MUS projects to get funding support at the district level, the Director of DoA's Planning Division said that funding support could have been much higher if a stable local government had been in place. He also claimed that the relationship between local government and communities could have been much stronger. He described how they have been unable to effectively monitor or backstop projects due to the unrest. Central-level staff were completely unable to travel and local staff were also being discouraged from visiting field sites. The Fund Board and CBWSSP also mentioned problems working with the communities during the conflict through delays in obtaining materials and monitoring due to road blockages.

The Maoists have now been incorporated into the government and are currently leading five ministries including several that are relevant to MUS. These include the Ministry of Local Development; Ministry of Women, Children and Social Welfare; Ministry of Forest & Soil Conservation; Ministry of Physical Planning and Construction; and Ministry of Information and Communication. Some individuals interviewed are hopeful that the future political situation will provide opportunity to Nepal, whereas others are more pessimistic about the potential situation. Regardless of how things evolve, the political situation will continue to affect all resource development in the country and MUS is no exception.

The political unrest did temporarily stall the decentralization movement within the government.[14] The Deputy Director General of DoLIDAR stated that the conflict had stopped the creation of technical units for each sector (irrigation, drinking water, etc.) within the DDC. Instead, the temporary arrangement has been direct technical support from the central government. (His department gives districts money both for irrigation and drinking water.) However, he described how the recent developments in the government are restarting the movement toward decentralization. Linking MUS with the renewed decentralization push would be beneficial. The DoA Planning Division Director also thought that MUS would be a great way to implement this shift toward decentralization because it could "be an entry point for empowering the people." He felt that MUS was an appropriate social mobilization tool and one of the best development examples for government to emulate because of the emphasis on community ownership. His prime concern during this transitional period was how best to channel the resources toward communities. Fortunately, with the recent inclusion of MUS in the DDC development guidelines, it will be now be easier for communities to receive the necessary financial support for MUS projects.

However, if there is future political instability, the MUS movement could be delayed. Even though there is tenuous peace, according to the DoLIDAR Deputy Director General, the government is not in line with the peace process and it is too difficult to say whether there will be true political stability soon.

## TAKING MUS FORWARD—CONCLUSIONS FOR SCALE-UP

### Questions of System Sustainability

Some partners are more cautious about the long-term sustainability of MUS projects and want to wait five years before concluding success. Due to the use of low-cost technology, World Vision was concerned that it would not stand the test of time and were doubtful that the communities would be able to truly handle long-term operation and maintenance. Helvetas-Palpa were also apprehensive about whether the structures were long-lasting and said that it was too early to prove that the technological components in MUS are robust. They said that scaleup was likely a good idea. However, until systems had been around for at least five years, it was not worth involving the government in wide-scale MUS implementation or working in the more remote areas of Nepal. Fortunately, some of the first MUS systems are just reaching the five-year mark, and appear to remain in good condition.

### Debate about Cluster Approach

A few interviewees debated the need for a cluster approach for scaleup. According to DoLIDAR, due to the interest of funding agencies, organizations attempt to cover all regions of the country with their work. This results in patchwork services. DoLIDAR criticized this approach because the scattered nature of coverage never translated into meeting the full demand of the district. And, if there are differences between the projects provided to two neighboring communities, the current situation of social disparity in the country is maintained, adding to political unrest. Instead, DoLIDAR is suggesting coverage of all demands for one district, including MUS, before servicing the next district.

The NITP Coordinator also believed that the cluster approach was ultimately better for development on the whole. However, in the case of MUS, he thought it best to establish one project in each district of the country, and let clustering happen organically from there. With one project in each district, all technical staff of the district could be trained at one project site. And, farmers from that district could visit a MUS project without being required to travel to another area to see MUS. Thus, demand for MUS from DDCs and VDCs would increase more easily. This idea was mentioned by others at the Kaski LA workshop as well.

Instead of using the political boundaries of districts, IWMI-Nepal suggested using a catchment or subcatchment perspective. Identifying many communities that would benefit from MUS within one catchment and working with them together would reduce technology support costs. Communities would be more willing to share resources if all were to benefit, resulting in larger positive impact.

Ultimately, whichever government body incorporates MUS within its structure will be responsible for choosing the most effective approach. Realistically, considering that IDE is already working on a few MUS projects with partners in multiple districts, NITP is working on four district pilot projects, and funders are keen to make sure that all districts are covered by any new initiative, it is more likely that the ad hoc approach will continue in the short term. However, if the DDC truly does become the "home" for MUS, then the cluster approach might become more viable.

## Should MUS Have a "Home"?

There are many perceived benefits to MUS having a "home" within a government body. It would have a greater chance of securing regular funding by being a specific department's purview. It would be more easily incorporated into department policy. And, it would benefit from the department's manpower and infrastructure. However, there are potential downsides to MUS having a "home" as well. As soon as MUS has a "home," other departments can claim it is no longer their responsibility. In the end, there might be less effort or coverage than the current situation of multiple departments doing their work and turning a blind eye to multiple uses. Most interviewed agreed that MUS scaleup had to be driven from the bottom in conjunction with policy support from the top and that ultimately, the middle (DDC) would lead. They mentioned many exemplary policies in Nepal that currently exist but have no teeth because no one is pushing for execution. They claimed that it was communities through the DDC/VDC structure that would have to push integration of water resource use and true coordination between government agencies for MUS.

## Moving Beyond the Current Model

In many of the interviews and meetings conducted for this chapter, there was a feeling that MUS could be so much more than it currently is. There were ideas floated about incorporating other productive uses like fish ponds, microhydro, or small-scale food processing. There was also a great deal of concern for increased efforts in sanitation to accompany the projects. Encouragingly, individuals were aware that these ideas were context specific and depended on the communities' needs and desires, available water resources, and the future mechanism for scaleup of MUS. With the new FINNIDA project, the incorporation of microhydro is being tested. And, with the momentum the approach has gained throughout the country, inclusion of other components in MUS may be just around the corner.

Both the search for matching funds and the Learning Alliance process have led to strengthened partnerships and a clearer vision for the future of MUS. They have also provided current implementers with much-needed feedback to strengthen implementation processes. Ultimately all stakeholders agree that while MUS should be scaled up within Nepal, the government must incorporate MUS into its structure to ensure future sustainability. And, coordination between all stakeholders is essential to provide all necessary support services—capacity building, market access, and technology access–in an integrated way. There are many positive signs that the MUS approach is an important piece of the future of water resource development in Nepal, particularly in the middle hills. And, throughout the interviews, there was a general feeling that projects like MUS are the future of Nepal. Most agreed that MUS is an extraordinary step toward community empowerment, effective water resource management, and coordination of all water resource development stakeholders.

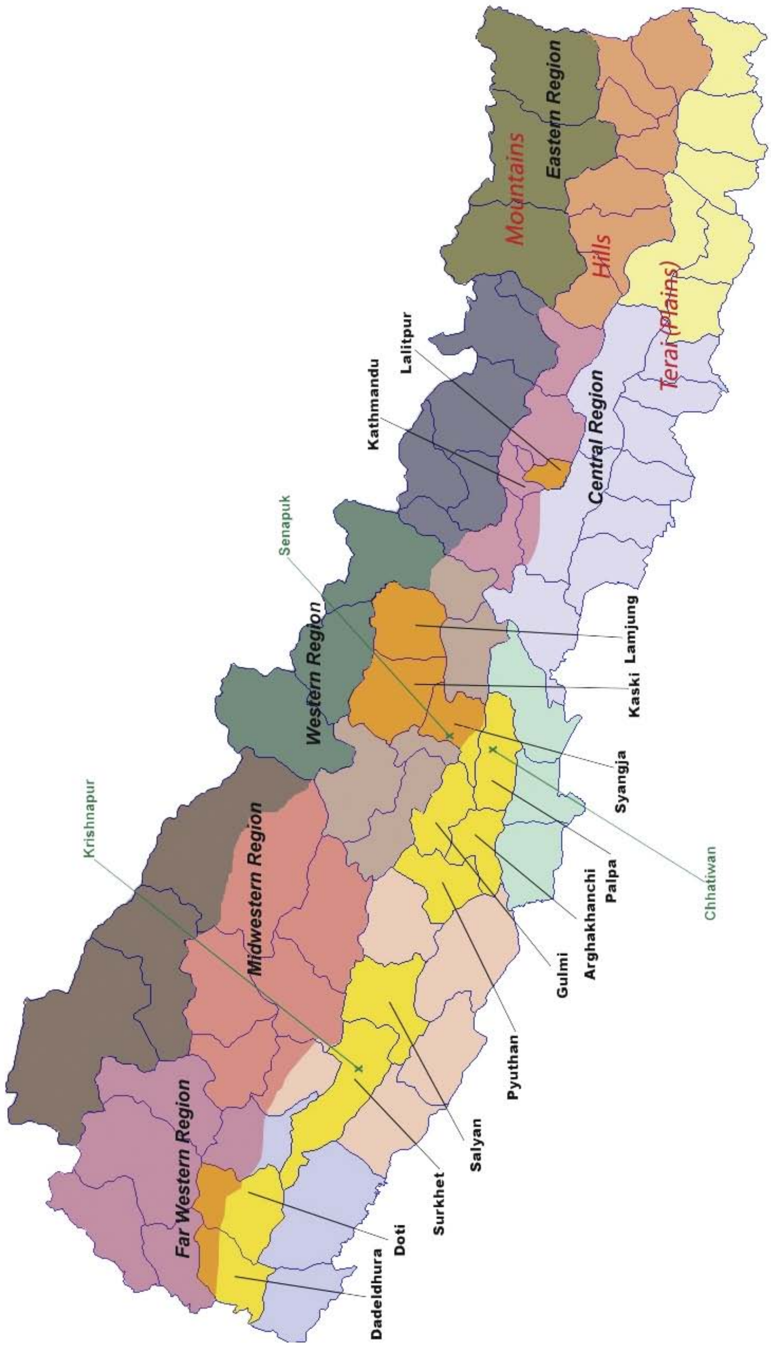



Plate 1 **Districts in Nepal where MUS projects were implemented.** Courtesy of Aaron Langton.

Plate 2 **Chhatiwan Tole cluster**. Photograph by Monique Mikhail.

Plate 3 **Traditional spring structure built in 1989.** Photograph by Monique Mikhail.

Plate 4 **Chhatiwan WUC member standing by hybrid tapstand.** Photograph by Monique Mikhail.

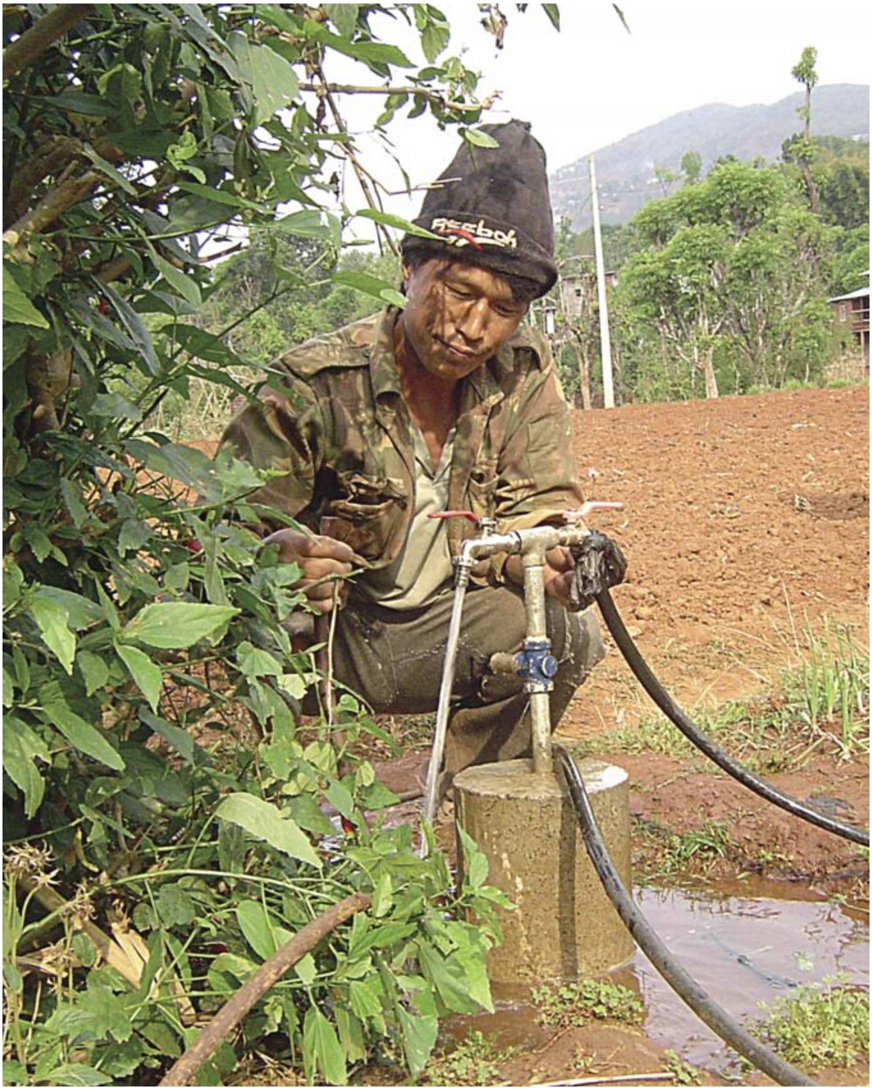


Plate 5 **Farmer kneeling beside irrigation offtake.** Photograph by Monique Mikhail.

Plate 6 **Filling up the drip header tank from the offtake.** Photograph by Robert Yoder.

Plate 7 **The marketing committee weighs farmer's produce at a collection center.** Photograph by Bimala Colavito.

Plate 8 **Senapuk village.** Photograph by Deepak Adhikari.

*Opposite:*

Plate 9 **Two storage tanks for Senapuk MUS system – domestic with productive overflow.** Photograph by Monique Mikhail.

Plate 10 **Using the hybrid tapstand.** Photograph by Robert Yoder.

*Below:*

Plate 11 **Marketing committee meeting at a collection center.** Photograph by Bimala Colavito.

*Opposite, top:*

Plate 12 **Krishnapur lined branch canal.** Photograph by Robert Yoder.

Plate 13 **Farmer displaying his homestead storage and nearby offtake.** Photograph by Ryan Yoder.

*Opposite, bottom:*

Plate 14 **Use of stored water for microirrigation (header tank + 4 drip lines).** Photograph by Ryan Yoder.

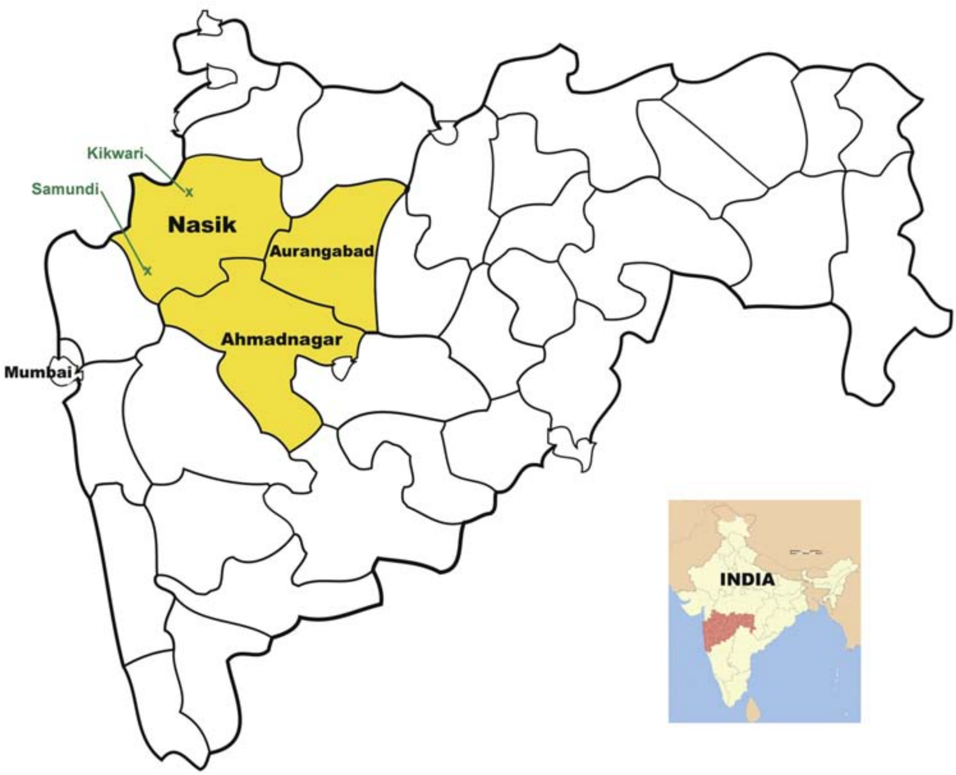



Plate 15 **Districts in Maharashtra where MUS work took place.** Courtesy of Aaron Langton.


Plate 16 **Pumphouse for new scheme in Kikwari.** Photograph by Monique Mikhail.

Plate 17 **Self help group members cultivating community plot.** Photograph by Monique Mikhail.

Plate 18 **Tribal families tending goats.** Photograph by Monique Mikhail.

Plate 19 **Samundi area in the dry season.** Photograph by Monique Mikhail.

Plate 20 **WEC chairwoman drawing water from the old hand pump.** Photograph by Monique Mikhail.

Plate 21 **Construction of the new Samundi well.** Photograph by Monique Mikhail.

# PART 2 THE MAHARASHTRA, INDIA EXPERIENCE

## INTRODUCTION

Maharashtra is a large state in India, containing 35 districts. For implementation of the CP-MUS project in Maharashtra, three districts were chosen—Nasik, Aurangabad, and Ahmednagar (see Plate 15)—partly for their proximity to the district headquarter city of Nasik where the IDE office is located, but also because they are water-scarce districts with a recent history of drought and intensive participation in Jalswarajya/Aple Pani projects.

Due to the small number of IDE staff in Maharashtra, it was realized early on that combining MUS work with another project would be the best approach for implementation. The MUS effort in Maharashtra was different from the Nepal experience in that it began with the Learning Alliance approach instead of project implementation. Through the Learning Alliance IDE sought partners for implementation. At the first Learning Alliance workshop (see chapter 13) IDE staff became aware of the state drinking water projects called *Jalswarajya* (meaning "water independence") and *Aple Pani* (meaning "own water") and decided to approach the project administrators to determine if they were a good match with MUS.

Jalswarajya and Aple Pani are two statewide drinking water projects with virtually the same structure and a community-driven, demand-led approach. Jalswarajya is funded by the World Bank, while Aple Pani is funded by KfW Bankengruppe. As identified in the Project Implementation Plan for Jalswarajya and Aple Pani, the overall aim was not simply to complete water supply schemes, but to make the communities self-reliant and to build the capacity of the communities to be able to link different water supply projects from various sources—Department of Irrigation, Department of Water Supply and Sanitation, etc.[1] Thus, more money was spent in the project on training and community organizing than on the materials to build the infrastructure. There was also a strong component of water source strengthening (largely groundwater recharge) to increase available water to the communities. IDE felt that the stated purpose of the project matched MUS. Staff also understood that the substantial project resources and government/NGO mechanism would provide a vehicle for testing implementation of MUS projects in the state. Therefore, IDE opted to use the state-level program as a vehicle for MUS propagation throughout Maharashtra.

## STRUCTURE OF PART 2

Chapter 8 provides an overview of the state setting, including a history of the water-scarcity situation and the process by which water resource development takes place in the state. Chapter 9 delves more deeply into the Jalswarajya/Aple Pani Project operation to give context for how MUS functioned with the state-run project. Chapter 10 covers the case of the village of Kikwari, a highly motivated community that has worked together to integrate water-development schemes to overcome their water-scarcity problems. Chapter 11 describes the story of the village of Samundi, a lower-caste community whose women were determined to shape their village development, including improved access to water resources. Chapter 12 draws out the village-level lessons from the two case studies as well as other partner MUS work. In chapter 13 the experience of the MUS Learning Alliance in Maharashtra is discussed with conclusions applicable to MUS scaleup globally.

## SELECTION OF CASE STUDIES

MUS work in Maharashtra largely occurred through IDE partner organizations (described in Chapter 13). IDE was directly involved in implementation work in just a small handful of communities in Nasik District. Of the villages interested in MUS, Kikwari and Samundi were those that had a firm grasp of the concepts of multiple uses of water and integrated water resource management. These communities were chosen for case studies because of their extraordinary motivation and insight. Samundi is a tribal village with very few resources, and yet the women in their community have shown incredible energy in developing their village. Kikwari was chosen to represent a community with significant ingenuity in water resource management; the Jalswarajya Project only represents the most recent in their history of integrated water resource management activities. Through these two cases, lessons can be drawn from the MUS experience in Maharashtra: working with communities participating in a state-run water resource development project to incorporate multiple uses.

CHAPTER 8

# THE MAHARASHTRA SETTING

Photograph by Monique Mikhail.

## WATER SITUATION IN RURAL MAHARASHTRA

According to the Government of Maharashtra Water Supply and Sanitation Department, most of the rural residents in the state have access to drinking water. The breakdown in levels of access is displayed in Table 8.1: "Full coverage" means there is one hand pump or stand post per 250 people, providing 40 liters/capita/day. The pump must be within 1.6 km of the village in the plains or, in the hilly areas, at a maximum elevation of 100 m. If the system only provides 10–40 liters/capita/day, it is considered "partial coverage." "Not covered" means people are receiving less than 10 liters/capita/day. According to the most recent habitation survey, posted in 1999, 78 percent of habitations[1] had full coverage (Government of Maharashtra 2008).

**Table 8.1: Rural domestic water coverage in Maharashtra in 1999**

| Category | Number of Habitations | Percentage of Total Rural Habitations in the State |
|---|---|---|
| Fully covered | 1,116,103 | 78 |
| Partially covered | 268,496 | 19 |
| Not covered | 38,065 | 3 |
| Total | 1,422,664 | 100 |

Source: Government of Maharashtra, 2008.

Supply of rural drinking water in Maharashtra is largely dependent on groundwater, about 85 percent (Government of Maharashtra 2008). Yet, groundwater resources are severely constrained and depleting, suffering from swings between extreme monsoon rain and drought. There have been large increases in abstraction of groundwater in recent years due to unregulated groundwater abstraction for irrigation and industry and poor management of drinking water systems (Dhawale 2004). Often groundwater is depleted by the dry season. Exacerbated by low and variable rainfall, this overabstraction of groundwater has created acute drought conditions in certain years. The result is often the failure of both private irrigation and public drinking water wells. And problems with pollution have risen as well (Pathak et al. 1999). A lack of monsoon rain or delayed rains result in critical shortages in drinking water, decreased food security, and failed agricultural activities. For example, the decrease in food security led to over 1,000 malnutrition-related deaths of tribal children in a three-month period in 2004 in the state. And more than 50 debt-ridden farmers committed suicide over the same period (Dhawale 2004).

The government has responded in the short-term through immediate relief of food, fodder, and employment and in the long term through dam construction and canal systems running hundreds of miles. And although urban residents are fairly well off in India, rural areas are much more impoverished. In these rural areas agriculture constitutes 80 percent of employment, making access to water essential. Yet of all agricultural land in India, 60 percent is in drought-prone areas, and most remains rain fed (Phadke 2002).

Rainfall patterns operate in a five-year cycle in Maharashtra, with three years of drought followed by two years of heavier rainfall. But some drought periods are worse than others. During 2001–2004 Maharashtra experienced a severe drought, and for a minimum of 3–4 months per year during that time drinking water for 10,000 villages (24 percent of villages in the state) had to be brought in with tankers (D'Souza and Lobo 2004). Cattle camps were opened in some of the worst affected districts to ensure livestock survival. And the government spent huge sums spraying clouds with chemicals to induce rain (Dhawale 2004).

High demand on the available water resources is part of the problem. As the second largest state in India, the estimated population of Maharashtra in March 2006 was about 104 million. The population continues to grow rapidly in both the urban and rural areas: the overall growth rate of the state from 1991 to 2001 was 22.7 percent, and the rural growth rate for the same time period was 15.29 percent (Government of Maharashtra 2006). This high rate of population growth is leading to ever-more-stressed water resources.

Water availability in Maharashtra is also heavily influenced by the choice of crop production, which is predominantly sugarcane. During the colonial period in India, dams and canal systems were built for the production of export crops including sugarcane, indigo, cotton, and wheat. Colonial administrators also created infrastructure to protect against drought and famine, but it was largely used for sugarcane production instead. Sugarcane is heavily subsidized through the inputs of water, fertilizers, and power (Bavadam 2006). And Maharashtra is now the largest sugarcane producer in all of India. After rice and wheat, sugarcane is the most important crop in the country (Phadke 2002).

Sugarcane cultivation is largely done under the cooperative model in the state. Farmers contract directly with sugarcane factories. Although this has directly increased the amount farmers receive for their crops, it has made them beholden to bank credit, chemical fertilizers, and hybrid seeds. This often leads to debt in poor-harvest years. Growing too much sugarcane has also been responsible for waterlogging and soil salinization (Phadke 2002).

The sugarcane needs about 2,500 mm of water over a 12-month period, and yet Maharashtra averages only 300–500 mm of rainfall per year (Bavadam 2006). During drought years farmers often lose part or all of their crops, severely constraining their resources and perpetuating their debt. Sugarcane cultivation was hard hit during the 2001–2004 severe drought. Due to reduced water availability and a virulent pest problem called Lokri Mava, cultivation of sugarcane halved over the four years (Dhawale 2004).

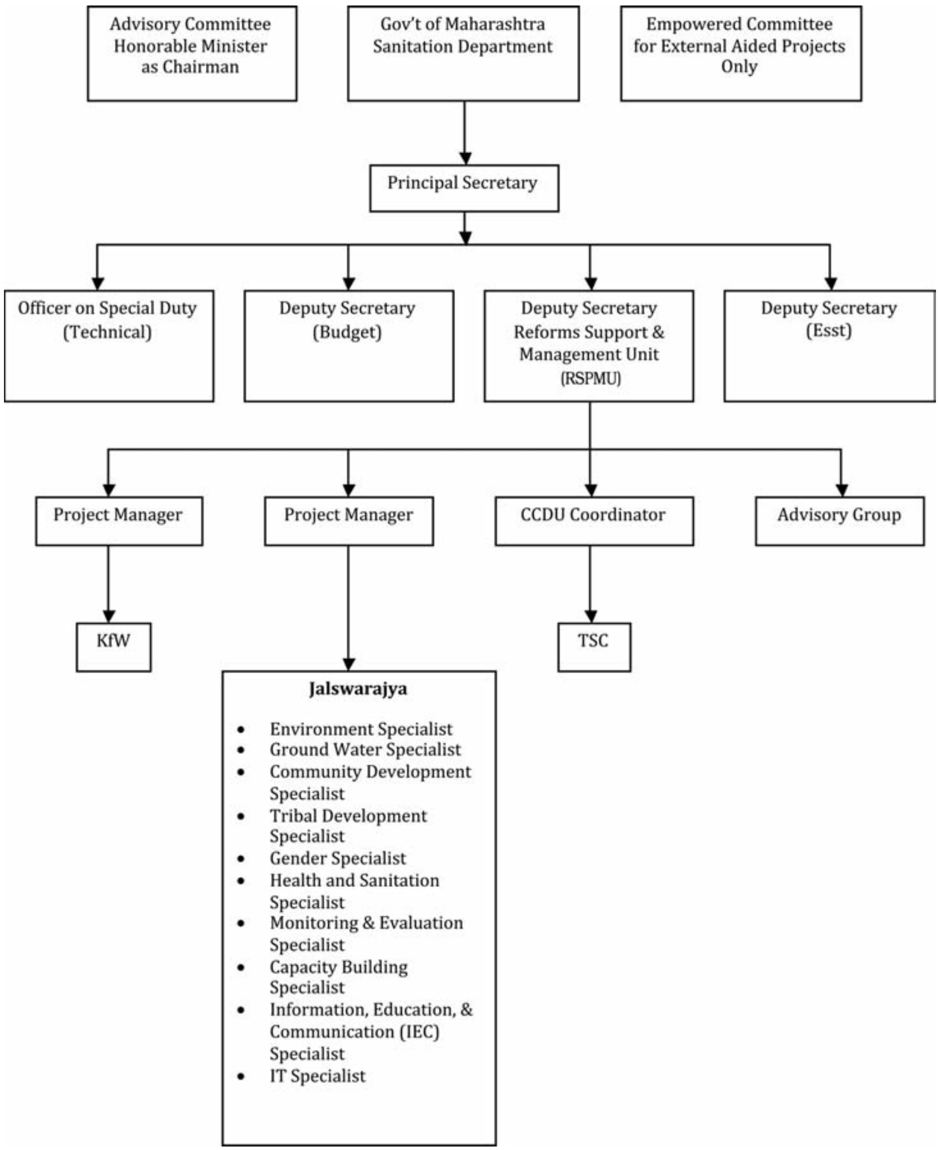
However, when viewing sugarcane cultivation over the past fifty years, it has actually increased considerably. In fact, just after the 2001–2004 severe drought, the area of sugarcane harvested in 2005–2006 increased by 61 percent (Government of Maharashtra 2006). This indicates that despite the chance of drought, agricultural factors are heavily weighted toward sugarcane production. And despite the cooperative model, most of the profits from the commodity in the state go to only 2 percent of landowners (Bavadam 2006).

## WATER RESOURCE DEVELOPMENT IN RURAL MAHARASHTRA

There are three organizations set up by the government of Maharashtra for implementing drinking water schemes in rural areas. The first is the Rural Water Supply and Sanitation Program (RWSS), which mainly works through the *Zilla Parishad* (District Council) to provide small water supply schemes to individual villages/*Gram Panchayats* (see the bullet point below for an explanation of Gram Panchayat). Under the Maharashtra Water Supply and Sewerage Board Act of 1976, the *Maharashtra Jeevan Pradhikaran* was set up to work for villages and small rural towns, but it builds larger water supply schemes and can work independently of the Zilla Parishad. The most recent is the Jalswarajya Project with funding from the World Bank and staff from the RWSS, meant to institutionalize the decentralization of the RWSS delivery to rural local governments and communities.

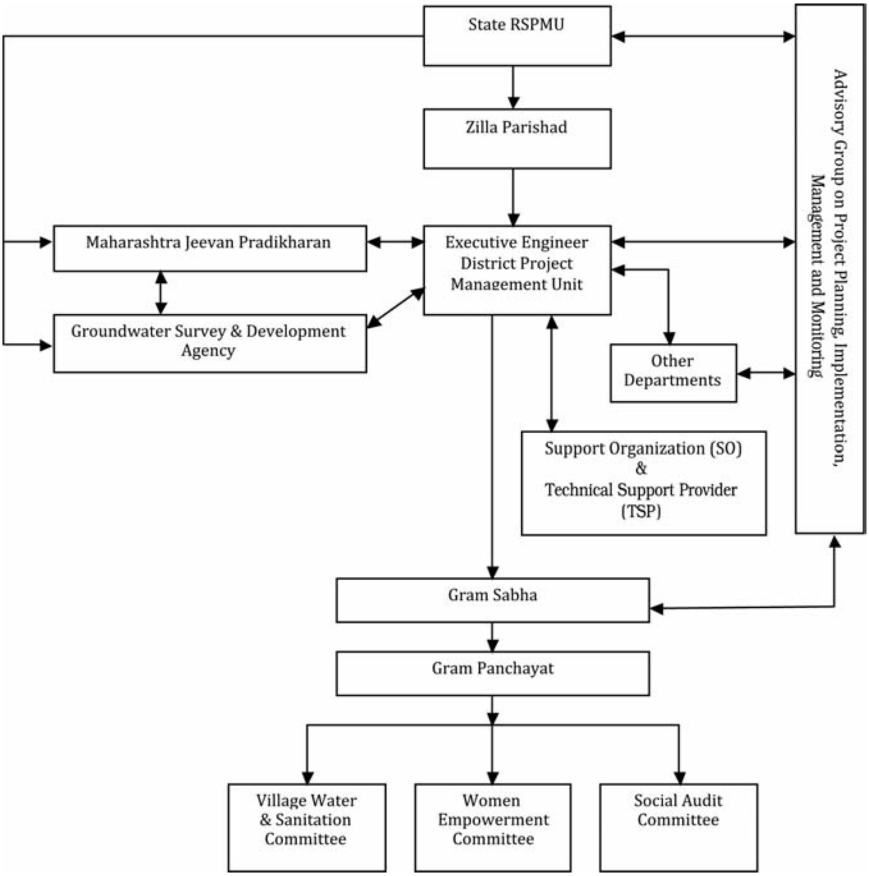
The state government has historically been responsible for implementing irrigation and drinking water schemes. The irrigation systems are predominantly large-scale irrigation canals and dams, while drinking water systems are high-cost schemes that are built by contractors and handed over to the Gram Panchayat. For the most part, NGOs have not been involved in scheme design or implementation until these recent state projects. However, NGOs have been involved in watershed work for the past few decades, focusing on

**Figure 8.1 Government structure relevant to Jalswarajya**




Source: Renjit, 2003.

**Figure 8.2 Interactions between various participants in Jalswarajya**




Source: Renjit, 2003

water budgeting, water source strengthening, and conservation education as the groundwater supply in the state diminishes.

The government structure as it relates to drinking water schemes and specifically the Jalswarajya Project can be seen in Table 8.2 and Figures 8.1 and 8.2. The panchayat system in India includes government bodies at the village, *Tehsil*,[2] and district levels as follows:

- Gram Panchayat (GP)—local government bodies at the village level in India with 10–15 members serving five-year terms. A Gram Panchayat can be set up in villages with a population of more than 500. There is a common Gram Panchayat for two or more villages if the population of these villages is less than 500. The *Sarpanch* is elected by the village community as the chair of the Gram Panchayat and receives a monthly payment of $10.
- *Panchayat Samiti*—a local government body at the Tehsil or Taluka level in India. It works for the villages of the Tehsil or Taluka that together are called a Development Block. The Panchayat Samiti is the link between the Gram Panchayat and the district administration.
- Zilla Parishad—a local government body at the district level in India. It looks after the administration of the rural area of the district, and its office is located at the district headquarters.

The functional head at the district level is the Chief Executive Officer (CEO) of the Zilla Parishad. The CEO reports directly to the state-level Panchayat Raj Ministry. However, the District Collector is responsible for coordinating all government departments at the district level. The District Collector can intervene and encourage the CEO to fund certain projects.

The block level is headed by a Block Development Officer (BDO) who is selected through an examination process and receives a monthly salary. Once an individual becomes a BDO, that person maintains the position until retirement at age 60 or earlier if promoted or demoted to some other department. The Block Development Office has eight committees:

- Minor Irrigation (below 100 ha)
- Drinking water and Sanitation
- Health
- Animal Husbandry
- Agriculture
- Public Works
- Education
- Integrated Child Development Scheme

At the state level, ministers are elected as members of the legislative assembly for five-year terms, and the ministry is formed with members of the majority party. The ministries are headed by the Chief Minister.

Although MUS-by-design has not happened in Maharashtra in the past, de facto MUS do occur to some level within the block-level structure. For example, if a community requests the BDO to recharge its well or build a well for a water supply scheme, the Water and Sanitation Committee (WSC) will conduct a survey within the community. If the survey reveals that there is an opportunity to build a dam across a stream or nearby river, the WSC will tell the BDO, who will ask the Minor Irrigation Committee to construct the dam. There are also many dams that were originally built for irrigation but, due to water scarcity, are being used for domestic water storage as well. Although these are both technically MUS, they are certainly not MUS-by-design.

**Table 8.2: Different tiers within the water sector in Maharashtra**

| Level | Government Departments | Elected Positions | Government Personnel |
|---|---|---|---|
| **State/Policy Level** | • Irrigation Department<br>• Water Supply and Sanitation<br>• Ground Water Survey and Development Agency<br>• Maharashtra Jeevan Pradhikaran (MJP)<br>• Reform Support and Project Management Unit (RSPMU) for Jalswarajya, Aple Pani, Total Sanitation Campaign (TSC), & Sant Gadge Baba Campaign | • Minister of Water Resources<br>• Deputy Minister of Water Resources<br>• Members from Legislative Assembly | • Secretary<br>• Deputy Secretary<br>• Principal Secretary<br>• Project Director<br>• Project Manager<br>• Advisors |

| Level | Government Departments | Elected Positions | Government Personnel |
|---|---|---|---|
| **District/ Intermediate Level** | • Zilla Parishad (District Council)<br>• Water Supply and Sanitation<br>• Ground Water Survey and Development Agency<br>• Maharashtra Jeevan Pradhikaran (MJP)<br>• Project Management Set-up (PMS) for Jalswarajya, Aple Pani, Total Sanitation Campaign (TSC), & Sant Gadge Baba Campaign | • President of District Council<br>• Vice President of District Council<br>• Chairman of Minor Irrigation and Water Supply<br>• District Council Members | • Chief Executive Officer (CEO) of District Council<br>• Deputy CEO for Minor Irrigation and Water Supply<br>• Project Manger/ Coordinator for PMS<br>• Technical and Financial Staff for Water Supply, Health, Agriculture, Public Works, Minor Irrigation, Ground Water |
| **Taluka/ Intermediate Level** | • Panchayat Samiti (Taluka Committee) | • Chairman of Panchayat Samiti<br>• Committee Members | • Block Development Officer<br>• Technical and Financial Staff for Water Supply, Health, Agriculture, Public Works, Minor Irrigation |

| Level | Government Departments | Elected Positions | Government Personnel |
|---|---|---|---|
| **Village/ Community Level** | • Gram Panchayat (Village Committee) | • Sarpanch (Village Committee Head)<br>• Members of Village Committee<br>• Chairman and Members of Village Water and Sanitation Committee<br>• Chairman and Members of Women Empowerment Committee<br>• Chairman and Members of Audit Committee | • Village Development Officer (VDO) |

Source: Government of Maharashtra [1] and [2] 2007.

# CHAPTER 9 PROJECT OVERVIEW

Photograph by Sudarshan Suryawanshi.

As mentioned above, the two state projects that IDE chose to work a MUS component into were Jalswarajya and Aple Pani. At the state level, the same people are responsible for administering both Jalswarajya and Aple Pani. Both projects have the same structure, with the major difference being the calculation of water requirement per capita. Jalswarajya uses a standard 40 liters/capita/day for domestic use, excluding livestock. In Aple Pani, livestock water requirements are considered in the calculation of domestic water need.[1] District is implementing Jalswarajya projects; Ahmednagar and Aurangabad are implementing Aple Pani projects.

The community-led approach of these projects was a new method for the state and a way to decentralize project management. Ultimately, all decisions for scheme construction and long-term management, including operation and maintenance, go through the *Gram Sabha*.[2] The project focuses on building the self-reliance of the community with other groups providing facilitation and support.

When IDE approached the state-level officials of Jalswarajya/Aple Pani, it realized that there was little flexibility in the Project. Jalswarajya/Aple Pani had a predefined menu of technology options and a set quantity of water that could be delivered to the community through the project. However, since the projects were designed to provide domestic water for the projected population in the year 2021, there would be excess water available in the system for the next several years, and its use was as yet unaccounted for. The state-level bureaucrats were not averse to having MUS incorporated into the project using this water, but they requested that IDE work directly with the support organizations (SOs) at the community level for implementation. Consequently, IDE began approaching various villages embarking on Jalswarajya schemes to assess their interest in incorporating a MUS component. Since IDE's scope was limited to Nasik, the Learning Alliance approach was used in Aurangabad and Ahmadnagar to strengthen NGO partnerships in those districts. IDE then encouraged partner NGOs to incorporate a MUS component in the communities they were working with on Aple Pani projects.

## THE JALSWARAJYA PROJECT

Since the direct MUS work IDE conducted in Maharashtra was in Nasik, and Jalswarajya was the Project for that district, the function of the Project is described here. As mentioned above, Aple Pani implementation was almost identical.

The Jalswarajya Project supports the government of Maharashtra in building the capacity of institutions and communities throughout the state and has the two following objectives:

- Increase the access of the rural communities to improved and sustainable drinking water and sanitation services; and

- Decentralize rural water supply and sanitation service delivery through three-tier Panchayati Raj institutions in the State.
  (Renjit 2003)

While the capacity support under the Project covers the entire state, the investment activities in the infrastructure were initially focused toward 3,730 Gram Panchayats in 26 districts, those that were not already covered under previously existing projects. The Project has three main components as shown in Table 9.1.

**Table 9.1: Three main components of Jalswarajya projects**

| **Component 1**<br>**Community**<br>**Capacity Building** | **Component 2**<br>**Community**<br>**Infrastructure** | **Component 3**<br>**Women**<br>**Empowerment** |
|---|---|---|
| • Community identifies their training needs (i.e. water budgeting, pump repairs, conflict resolution, etc.)<br>• Exposure tour to ideal villages (model projects)<br>• Actual training programs<br>• Gram Panchayat strengthening fund | • Implementation hardware<br>• Technical Service Provider (TSP)<br>• Contractors | • Needy women are identified by the participatory rural appraisal activities (only the needy women are brought into self-help groups [SHGs])<br>• Seed money and skilled trainings given for income-generating enterprises<br>• One gender specialist posted at district level to facilitate |

Source: Renjit 2003.

## CONTRIBUTORS

The major contributors to the Jalswarajya projects are as follows:

- District Facilitation Team (DFT)
- Technical Support Provider (TSP)
- Capacity Building Consortium (CBC)
- Support Organization (SO)

Although the District Rural Development Agency, Department of Agriculture, District Water Supply and Sanitation Committee, and Ground Water Development Authority were meant to provide a supportive role for villages undertaking Jalswarajya projects, the majority of the support truly came from the local level—the GP and the SOs.

## THE PROCESS

To initiate the process of village selection for schemes, the Jalswarajya Project staff sends a letter to every GP in the selected Project areas, including the requirements for acceptance and how to apply. It also puts advertisements in the newspaper so that communities can approach independently. Communities, through their GP, apply to be shortlisted for inclusion in the Project. All villages willing to accept the Project rules receive a scheme unless the number applying in that particular area is greater than the number the Project can support. If this is the case, the villages are selected based on the following criteria:

- Quantity and quality of available water and state of existing water supply and sanitation facilities
- Proportion of families below poverty line and tribal families
- Level of dues-collection efficiency
- Agreement to adhere to the Project rules
  (Renjit 2003)

Villages are much more likely to be selected if they have already participated in two other state programs—the Soil and Water Conservation Program and the *Sant Gadge Baba* Village Sanitation Campaign. These two projects were initiated by the state as ways to create incentives for community watershed and sanitation work without direct project intervention by the state. In these programs, the communities were encouraged to undertake their own water- and soil-conservation measures with their own resources and then to convey their work to the state to potentially win prize money for their accomplishments. See Table 9.2 for the criteria used to judge community efforts for receipt of prize money.

**Table 9.2: Criteria for winning awards through the two programs**

| Soil and Water Conservation Program | Sant Gadge Baba Village Sanitation Campaign |
|---|---|
| • Community participation<br>• Water conservation and resolution of drinking water problem<br>• No water tanker truck required in summer<br>• Waste land development<br>• Number of Self-Help Groups formed<br>• Excavation/Desilting of ponds<br>• Forest development<br>• Preventing labor migration<br>• Water recharge | • The village appearance—does it look clean<br>• The village households all have latrines<br>• No open space defecation<br>• No trash thrown on the roads<br>• Drainage system good<br>• Village walls and households look nice and well-maintained<br>• There is some roadside planting for village beautification |

Source: Renjit 2003,

In fact, any community receiving a Jalswarajya project is required to commit to being 100 percent open-defecation free by the end of the first year of the project. Most have already begun this work through the Sant Gadge Baba Village Sanitation Campaign.

Once the potential villages are selected, Jalswarajya sends a letter of acceptance and then visits the community to explain project conditions and to draw up a formal contract to be signed by the GP chair. Project staff also provide training for the GP on how to select the organizations and contractors from the predetermined Project list. The community is required to choose a technical service provider (TSP) to design the system, either a private or government consultant. Once the GP of the village chooses a TSP, the Project sends their District Facilitation Team (DFT) to the village along with the TSP to conduct a survey on the existing water supply system. The DFT and TSP jointly compile a report and give it to Jalswarajya staff. If the report is approved, then the village is approved for a scheme.

Once the project is approved, the GP is responsible for selecting a local NGO to be their support organization (SO). Jalswarajya puts an advertisement in the newspaper announcing which villages are receiving projects, and the NGOs previously selected by Jalswarajya to be SOs in that area can approach the village to work with them. The SOs first approach the Sarpanch[3] who decides along with the rest of the GP which NGO they wish to work with. After the SO is selected, a Gram Sabha meeting is held, and the process of the project is explained. The SO helps them create the three required committees for the project—Village Water and Sanitation Committee (VWSC), Women Empowerment Committee (WEC), and Social Audit Committee (SAC). The Gram Sabha elects leaders for the three committees and makes a list of the members. The SO then gives this formal list of members and leadership to the DFT. Projects are meant to last a maximum of 18 months, although extensions may be granted. However, the SO's presence diminishes after 18 months.

Immediately after the formation of the three committees, Jalswarajya gives the VWSC money to visit "model" villages. The SO then conducts a participatory rural appraisal in the village and gives the information to the TSP and DFT. The TSP makes the Village Action Plan, which includes the water supply and drainage-system design and the projected system costs. The SO helps the VWSC establish a bank account, and the community is given the first installment of 40 percent of projected scheme costs. There is no set ceiling for what Jalswarajya will spend on a scheme, but the budget must be approved by the DFT. Communities are required to contribute 10 percent of total scheme costs in cash, labor, or both. Tribal communities are only required to contribute 5 percent.

The SO then begins organizing women Self-Help Groups (SHGs), on average 5–6 groups with 10–12 women each. These groups also establish bank accounts for their savings. The reasoning behind the formation of SHGs is education of women about income-generating options. SHG members often overlap with members of the Women's Empowerment Committee (WEC). However, while the SHGs do not receive any direct funding from Jalswarajya for development activities, the WEC does.

Each DFT has a Capacity Building Consortium (CBC) assigned to act as a "mother NGO" to the SOs in the district. The CBC is responsible for trainings, monitoring, and facilitation of social, technical, and financial matters. If the CBC is capable of providing training on a subject the community is interested in, then it will do so. Otherwise, it acts as a coordinator to find expert NGOs on the subject of interest to train the local community and SO. Well-functioning CBCs also work with the Block Development Officers to assist them in monitoring the villagers' progress. They provide input to the DFT and SO for resolving village-level conflicts and community-contribution collection. Unfortunately, the CBC that was selected for Nasik District (where the two cases of Kikwari and Samundi are located) was removed from their role a year into the Project. Therefore, SOs were forced to become more involved than in other districts, helping communities select other local NGOs for training activities.

In Nasik (and other districts where the CBC was removed) the WEC invites 2–3 training NGOs who have different training specialties to give presentations about their trainings. The WEC then selects the training they are interested in and makes an agreement with that NGO for a 3-day training workshop. At the end of the training, the NGO is supposed to help the WEC write a project report, get a bank loan, and start the business activity of their choice.

At the same time, the VWSC is working with the TSP to hire contractors for the various components of scheme construction. The project engineer designs the project according to preestablished parameters. Originally, each project calculated the projected population for 15 years from the start of the project. The storage capacity required for the water tank was then calculated as:

- Daily water requirement = Design population x rate of water supply (40–45 liters/capita/day)
- Storage capacity = Daily water requirement/2 (assuming the tank fills twice/day)

However, the state-level officials of the Jalswarajya Project recently amended the requirements by increasing the daily per capita water requirement from 40 to 55 liters due to increased community demand. They also will be planning future projects for a 30-year projected population growth. The schemes were only supposed to take 18 months to complete but are actually taking anywhere from three to five years, often leaving only ten years of project operation upon completion until full capacity is reached.

Once the project design is completed, the contractor often hires community members for unskilled labor and skilled labor from outside the villages. The VWSC is responsible for purchasing the materials and paying the contractors. Payment to each service provider is done on a monthly basis depending on the number of days worked in the village that month. A portion of funds is given only upon completion of the work and subsequent report.

Jalswarajya also encourages the continuation of the Soil and Water Conservation Program through a component of the project called "source strengthening activities." These are undertaken at the same time as scheme construction and largely consist of groundwater recharge measures. Once the system is constructed, the VWSC is required to collect a water tax to ensure proper operation and maintenance of the completed system.

Water quality is also an issue of concern to Jalswarajya projects. When the GPs are selected, the first step is to collect and test the water quality. The results are shown to the health-and-hygiene specialist at the district level. The community is then trained on chlorination, and small testing kits are given to the GP to regularly monitor the water quality. However, once these trainings are performed, it is up to the GP and SO to ensure water quality. The Jalswarajya Project provides the chlorine during the project period, but post project it is the VWSC's responsibility to fund chlorination through the water tax. In a few cases there is community-level filtration using a gravel filter, but Jalswarajya does not pay for point-of-use treatment of water.

## COMMITTEE RESPONSIBILITIES

To promote total participation in the project, the Jalswarajya project encourages all villagers to participate in at least one committee. Descriptions of committee roles are as follows:

- Village Water Supply and Sanitation Committee (VWSC)
  The VWSC is the key organization in the village responsible for planning, implementing, and managing the water supply and sanitation services of the Project. VWSC is required to have adequate representation of all stakeholders including women, Scheduled Castes, Scheduled Tribes[4] and community-based organizations. Fifty percent of the members of the VWSC must be women. The VWSC is a committee of the GP and remains accountable to the Gram Sabha; it is therefore a formal part of the government structure. The VWSC is monitored by the Social Audit Committee.

- Women Empowerment Committee (WEC)
  The committee of 16 persons is meant to empower women to play an active role in water and sanitation issues as well as other forms of village development. Separate funds and training activities are provided for the WEC. The committee must have a composition of at least 75 percent women. The GP and SO provide technical support for the WEC to start income-generating enterprises.

- Social Audit Committee (SAC)
  The Social Audit Committee, appointed by the Gram Sabha, monitors the financial activities of the VWSC for project transparency. They are responsible for maintaining a record of expenditures.

## SYSTEM COSTS

The cost of each Jalswarajya project depended on the static lift[5] of water and distance from the water source. The general cost guidelines for infrastructure are:

- Hilly region—INR 2,120 ($53) per capita
- Project with more than 30 m lift—INR 1,790 ($45) per capita
- Project with less than 30 m lift—INR 1,390 ($35) per capita

## INCORPORATION OF MUS

After IDE discussed MUS with the state-level Jalswarajya staff, the concept of kitchen gardens was meant to be incorporated into the trainings provided by CBCs. However, depending on the CBC in the district, this information may or may not have actually been transferred. Jalswarajya did not encourage the use of any water from the scheme but did encourage households to dig channels for wastewater conveyance from the house to the kitchen garden.

As mentioned above, the first systems (including Kikwari and Samundi) calculated the domestic water requirement for 2015. Therefore, once the schemes are completed, there will currently be excess water in the system that can be used for productive use. In order to encourage MUS within Jalswarajya, IDE visited the communities and met with the VWSC and other villagers. The concept of MUS was explained and IDE encouraged villagers to use some of the surplus water for productive use to increase income. The specific productive use suggested was drip irrigation of kitchen gardens using IDE's "family nutrition" drip irrigation kit (see Appendix 5). These kits include all components necessary to irrigate a 20-m$^2$ plot. IDE gave demonstrations of the kits and explained the benefits of using drip for kitchen gardening, the care and maintenance requirements of the kits, and cost. Considering that Jalswarajya encouraged reuse of wastewater, IDE also encouraged the use of wastewater for irrigation of kitchen gardens to augment the productive use water from the scheme. Although the kitchen garden microirrigation kits have a filter to remove particulates that can clog the drip system, the use of wastewater increases the possibility of clogging. Therefore, IDE recommended that farmers filter the water first through a cloth into the storage bucket or bag and clean the filter assembly of the kit frequently. IDE continued to meet a few times per month with the various communities, participating in VWSC meetings and discussing MUS with villagers. The number of families with space for kitchen gardens was determined, and any community land that could be irrigated was explored.

## CURRENT STATUS

The Jalswarajya projects that IDE is working with were completed in early 2008. The initiation of the remaining MUS activities (largely installation of kitchen gardens) is now occurring, and the SOs are training villagers on how to use microirrigation.

CHAPTER 10

# KIKWARI: COMMUNITY-LED INTEGRATED WATER RESOURCE MANAGEMENT

Photograph by Monique Mikhail.

Kikwari village was chosen as a case study in Maharashtra because it is a village that encapsulates the spirit of integrated water resource management. Their creativity, innovation, and commitment to their community has allowed the villagers to protect and effectively manage the water resources available to them. Their story is truly unique, yet their success lends hope and instruction to other villages attempting to meet their multiple water needs in the dry state of Maharashtra, India. Their ability to garner financial resources from the government and propel themselves forward to become a model village is an inspiration to other villages in the state.

Much information for the case study came from interviews with IDE field staff that have worked and continue to work with Kikwari community members throughout the Jalswarajya scheme construction. Field staff had conducted a participatory rural appraisal and shared the information from that process. They had collected village demographic data from the Village Development Officer. They had also met with leader farmer Mr. Keda Barku Kakulate and spoken individually with 10 households in the tribal area and 20 households in the village settlement area. The remaining information was collected during a visit of international and national IDE staff during April 2007, during which the following meetings were held:

- Interview with Mr. Kakulate
- Interview and village tour with the another VWSC member
- Interview with a woman from the SHG farming the community land
- Interview with six of the SHG members as a group
- A discussion with a group of young men hanging out on a village street
- A discussion with a doctor in the village
- Interview with visitors from a neighboring community who had come to see the work in the village to inform their own village water work

## SITUATION ANALYSIS

### COMMUNITY SETTING

#### Location

The Kikwari village is located on the banks of the Hatti River in the Sahyadri Mountain Range in the Dang region of Nasik District in the state of Maharashtra. It is about 110 km northwest from Nasik city, the district headquarters, and 20 km from Satana, the Taluka headquarters. An all-weather road allows easy access to Satana market from the village. A forest bounds the village on one side.

## Population/Demographics

According to the 2001 census, the total village population of 1,764 residents is comprised of 242 households. The farming families are mostly Maratha (upper caste). There are 4–5 Muslim households and 7–8 Dalit households (Scheduled Caste). The 60–65 tribal households are Bhilla (Scheduled Tribe). Seventy percent of the population live in the village settlement, and 30 percent live on farms located within 1–2 km from the village.

## Socioeconomic Situation

About 75 percent of the families have land (172 households) and 25 percent are landless (mostly tribal). Nine percent (21 households) are farm laborers, making agriculture the primary livelihood in the village. Landholdings of the villagers are 1–10 ha. Annual income from agricultural land is INR 10,000–INR 50,000 per hectare ($220–$1,100). Some households have family members in other sectors like education, electricity supply, medicine, and engineering. The average annual family expenditure is INR 10,000–INR 20,000 ($220–$440). Food requirements, education, clothing, and health expenditures comprise 70–80 percent of total income. About 89 percent of the population is literate. There are a total of 93 households with annual income below the poverty line (about INR 20,000—$490) and 139 households with income above the poverty line.

## INITIATING CONTACT WITH THE COMMUNITY

The region that Kikwari is located within is drought prone and has experienced below-average rainfall for several years. This has caused the water level in open wells to drop. Over the past ten years, the nearby river that once held adequate flow year-round only has sufficient flow during the rainy season in heavy rain years. For many of these reasons, Kikwari was selected for participation in the Jalswarajya Project, making it a candidate for inclusion in the MUS action research activity.

IDE was interested in Kikwari partially because it was near to Nasik city, the headquarters of the office in Maharashtra. IDE had also previously established good relationships with the village leader and Baglan Seva Samiti (BSS). BSS, a local NGO, is Kikwari's Support Organization (SO) for the Jalswarajya Project. But perhaps most important, Kikwari has a long history of integrated water resource management. Through the progression of various projects, the community has demonstrated a keen understanding of the concept of integrated water resource management and the need for project designs that account for multiple water uses. So not only did the IDE MUS goals and Jalswarajya Project goals overlap, but the community consciousness was well-primed to take the MUS concept and run with it in exciting new ways.

When initiating MUS efforts, IDE staff met with BSS to get information about the villages included in the Jalswarajya Project that they were working with. BSS told IDE of Kikwari's interesting water history. IDE staff then approached the Gram Panchayat (GP) members in Kikwari and the Village Development Officer who coordinates activities of the GP on behalf of the Block Development Office. IDE met with BSS to discuss potential MUS work within the Jalswarajya Project.

## INTEGRATING WATER RESOURCES

The story of Kikwari's water resource management is inextricably linked with one leader farmer by the name of Mr. Keda Barku Kakulate (see Figure 10.1). Without his insight and leadership, the community would probably not be where it is today. In 1998 Mr. Kakulate heard about a group of 14 farmers who were going to Israel to learn about irrigation application for raising agricultural yields. As a wealthy farmer who was willing to experiment with new technologies, Mr. Kakulate knew that the trip to Israel would be useful to him. He had also met a farmer from a nearby town who complained that the farmers who had previously traveled to Israel never used the water resource management knowledge they gained. Mr. Kakulate vowed that he would keep his mind open and work to apply his new knowledge when he returned from Israel.

When he came back from Israel, Mr. Kakulate used some of his new knowledge on his own fields. But then in 2001 a severe four-year drought hit the region, and the wells ran dry. They were forced to bring in tankers for

**Figure 10.1 Mr. Kakulate in front of his home**

Photograph by Monique Mikhail.

drinking water and had no water for their crops, negatively affecting food security for many in the village. Because Kikwari had never before faced water scarcity, Mr. Kakulate realized that something must be wrong with the way they were managing their water resources. It encouraged him to recall his water-management training in Israel and come up with viable applications for the whole village.

In 2001–2002, the government of Maharashtra initiated two different projects dealing with water resources—the Soil and Water Conservation Program and the Sanitation Campaign. Since both programs were initiated at roughly the same time, Mr. Kakulate saw the connection between the two and encouraged participation of Kikwari in both.

## SOIL AND WATER CONSERVATION PROGRAM

Partly in response to the statewide drought, the government of Maharashtra instigated the *Mahatma Phule Jal Bhumi Sandharan* (Soil and Water Conservation Program) as a way to create incentives for community watershed work without direct project intervention by the state. As mentioned in chapter 9, this program encouraged villages to undertake soil and water conservation efforts on their own with the hope of winning prize money from the state if their work was deemed successful by the Program. Mr. Kakulate's visit to Israel had uniquely positioned him to work on restoring the community's watershed. The two main goals were to recharge their wells and obtain prize money from the state that they could spend on other community projects.

Mr. Kakulate motivated the village to join him in the water-conservation efforts, starting with the nearby Hatti River. In 2003 the community built 24 underground check dams along 1.5 km of the river by creating a trench (4 feet wide and 15 feet deep) and filling it with porous material. With drought still prevailing a year later, the community was unconvinced that they had actually achieved much recharge. So they decided to build another 24 trenches along the same 1.5 km stretch. Construction was completed just before the monsoon season so that the trenches would fill with silt during the monsoon floods. Luckily, in 2005 and 2006 the drought ended and they received a sizeable rainfall, recharging the groundwater.

Mr. Kakulate recognized the importance of the 7–8 streams in the village catchment with farmland all along the banks. He convinced the farmers that if they joined together for more construction work, they could better recharge their wells. He requested a portion of the prize money from the village and, in addition, collected an INR 500–INR 1,000 contribution per farmer (depending on land size). Together, they built earthen check dams across the streams with outlets leading to recharge ponds.

Energized by their efforts, the community next focused their energy on the 106-ha forest adjacent to the village. A forest committee was created to design a forest conservation plan. First, they protected the forest by banning wood cutting. Instead, farmers were encouraged to use wood from their own

**Figure 10.2a Rainwater harvesting structure**

Photograph by Ratnakar Pawar.

**Figure 10.2b Handpump fed by rainwater**

Photograph by Ratnakar Pawar.

agricultural land. Landless villagers were only allowed to take wood from dead trees, not cut from live ones. Second, animal grazing was banned in the forest. Villagers were asked to feed their animals fodder from crop waste. Those with goats were allowed to graze them at the sides of the streams, but not in the forest. These few simple forest-management changes brought about significant behavioral change. And because the whole community was involved in the Program, there was no need for policing. Everyone followed the rules the community had established. The forest committee was disbanded after these successful efforts.

The village knew that the Zilla Parishad had money available from their 12th five-year plan, so they requested funds to build two cement check dams. One was built on the Hatti River, and the other was built on a big stream that divides Kikwari from the neighboring village. To use drainage water from the rainy season for groundwater recharge, they made two small drainage canals that collected runoff from the road. They also installed a rainwater-harvesting structure (Figure 10.2a) on the primary school that filters water through a three-layer sand filter, thus recharging water to a village well with an attached hand pump (Figure 10.2b). This structure revived the previously dry well that serviced the hand pump. Now, the GP is encouraging installation of similar structures on village houses. This hand pump is largely used for the school. Villagers also use it during power cuts or when the domestic-system tank is empty.

Kikwari then sought to expand their work to the neighboring communities. A canal on the Aram River that was used in the past by the whole region had fallen into disrepair and was no longer being utilized. Kikwari organized 14 surrounding villages to work with them in repairing the canal. They collected a contribution from farmers who had land along the canal and approached a local sugar factory to give them a donation as well. With these moneys they dredged the canal.

The villagers also realized that along with groundwater recharge, they needed to use water more responsibly. Mr. Kakulate encouraged people to irrigate horticulture with drip irrigation systems instead of cultivating water-thirsty sugarcane. At the beginning there were only a few who were interested in making the shift, but now there are 60–70 farmers who have 1–2 acres of fruit trees.

Individuals were also prohibited from putting in bore wells. The village lies on volcanic rock with a shallow aquifer, an impervious layer below it, and a deep aquifer below that. The shallow aquifer can be accessed with an open well without harming the deep aquifer. But to put in a tubewell, the impervious layer is drilled through. This creates a passage from the shallow aquifer to the deep aquifer and can cause contamination of the deep aquifer. Water can also leech from the shallow aquifer to the deep one, decreasing the amount of water available for the community wells. For all of their soil and water conservation efforts they won two awards from the government.

## SANT GADGE BABA VILLAGE SANITATION CAMPAIGN

At the same time as the Soil and Water Conservation Program was being promoted, the government of Maharashtra began the Sant Gadge Baba Village Sanitation Scheme. Similar to the Soil and Water Conservation Program, this campaign was meant to create incentives for community action on sanitation. It encouraged communities and schools to become involved in breaking the fecal-oral contamination chain by changing habits and behavior patterns. Activities promoted through the campaign included the construction and use of dry-pit latrines, hand washing, keeping food and water covered, using safe drinking water, and maintaining a clean environment by constructing drainage/soak pits and garbage disposal.

Before the sanitation campaign each family had its own compost pit close to its house. There were animal sheds in the village and no organized way for removing waste. To start the sanitation campaign, the villagers were encouraged to move the animals and compost pits from the village settlement out to their farms. Then, 60–70 percent of the households each made a 3 foot by 3 foot by 5 foot soak pit by their houses, which was then filled with gravel. A pipe was inserted to carry water from the bathroom and kitchen to the center of the pit. The remaining houses were connected to village gutters to remove wastewater. Due to both location of houses and cost, not all houses could be connected to the village drainage system. After this first effort, they won an INR 25,000 ($612)[1] award at the Taluka level.

The community decided to use some of the award money to continue Sanitation Campaign efforts. Every 100 feet, the drainage system was covered with chambers where the drainage was collected for solids to settle. In order to avoid problems with open drains and a disposal lagoon, Kikwari villagers agreed to establish a wastewater recycling system. The drainage water was piped to a collecting tank at the edge of the village. The drainage system is designed to avoid choking due to household debris, and, as such, connecting latrines or septic tanks to the greywater drain is not allowed. From the primary collection tank where all heavy materials settle, the greywater passes through two sand filters and is stored in a second tank (see Figure 10.3). Once this system was constructed, most households decided to connect to the village gutters using award money and stopped using their soak pits. Only 10–15 households still use the soak pits.

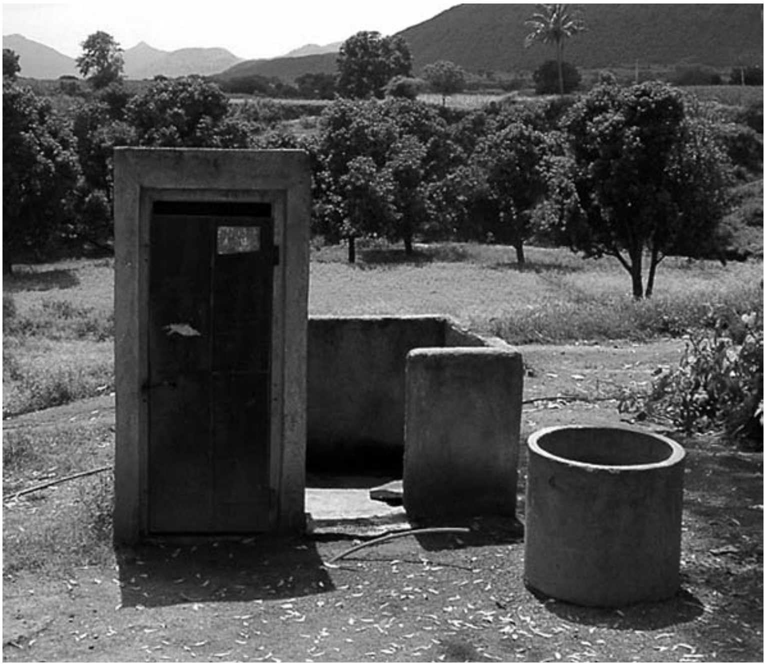
Every day approximately 13,000–14,000 liters of recycled water is collected. It is then used to irrigate a 1.5-acre community garden. The community decided to have GP staff cultivate the plot with custard apple and coconut and sell the produce to augment their low salaries. A second wastewater collection tank was built near the primary school. It uses the same type of recycling system and irrigates the ornamental plants around the school.

Next, the villagers established four garbage-collection sites and made the GP responsible for garbage collection. The garbage is disposed in a masonry tank where it is recycled by the Nadep method.[2] Household waste is also used

**Figure 10.3 Filtration of village wastewater**

Photograph by Ratnakar Pawar.

**Figure 10.4 Community latrine**



Photograph by Ratnakar Pawar.

for vermi-composting or organic manure. For aesthetic and health purposes, the GP sweeps the roads once a week. Each household is responsible for cleaning the area surrounding its home. Every house then constructed a dry-pit latrine. Fully 70–80 percent of the households paid for their own latrines. At this point, the village won an award of INR 500,000 ($12,240) from the district government. With this new award money and labor contribution from the families themselves, they built latrines for the poorer/lower-caste households. At the end of the year (2004), they won another INR 1,000,000 ($24,480) prize, this time from the division level, for all sanitation work they had completed. Currently, there are 218 households with their own latrines as well as eight community latrines (see Figure 10.4) and one latrine for the nursery.

They rounded out the Sanitation Campaign work with village beautification. All village buildings were painted pink, and trees and flowers were

**Figure 10.5 Solar street lamp**

Photograph by Ratnakar Pawar.

planted throughout the village. More award money was used to install ten solar street lamps (see Figure 10.5). Each lamp would have cost INR 26,000 ($637), but the government gave a subsidy because they chose to use solar energy. Due to 16 hours of power cuts per day in the area, the solar lamps were a way to get light without using electricity from the grid. In 2005 Kikwari received the state-level prize of INR 750,000 ($18,360) and in 2006 were awarded INR 200,000 ($4,896) from the national level.

## PREVIOUS DOMESTIC WATER SYSTEM

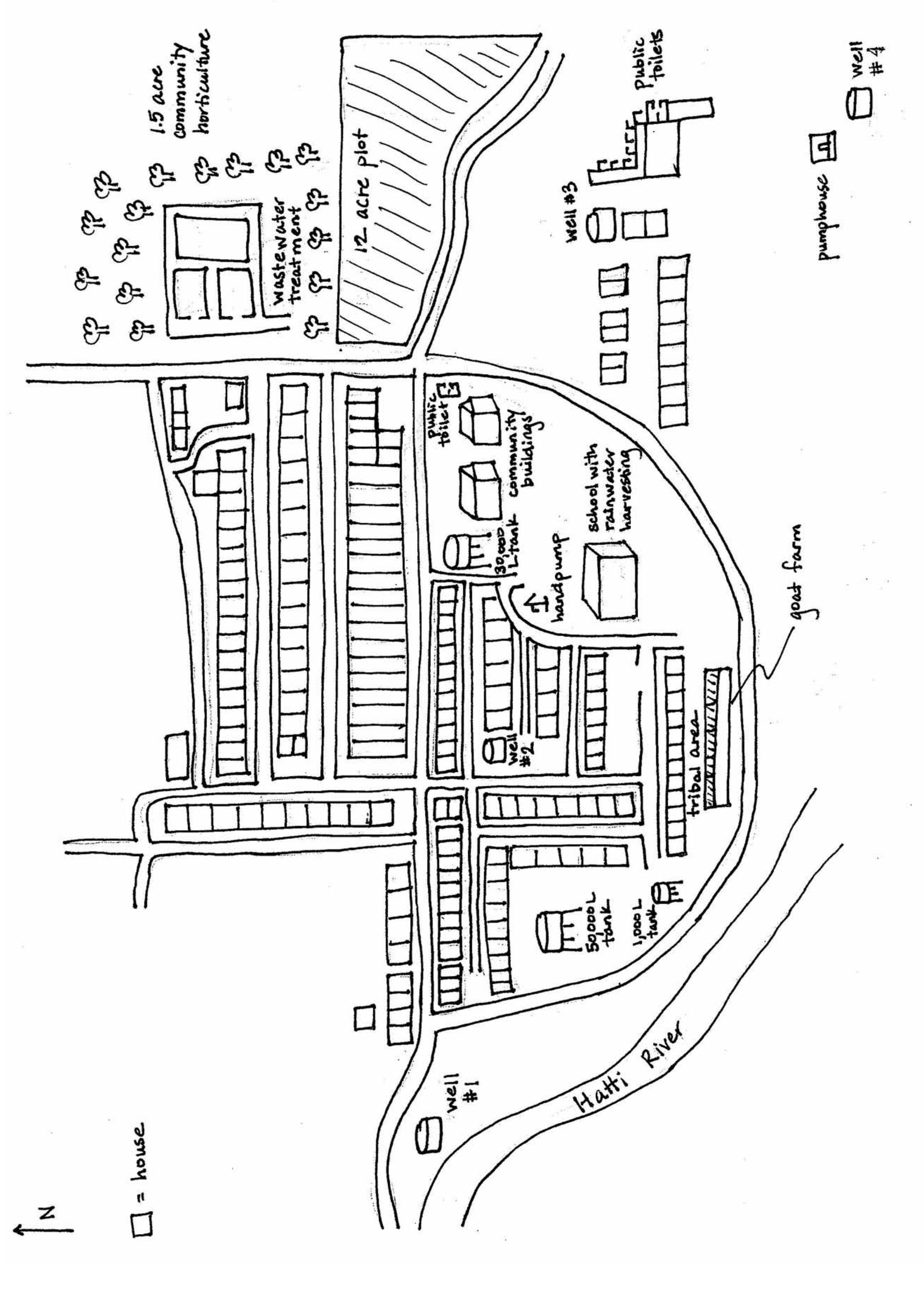
In the 1960s and 1970s Kikwari villagers used a community well that the GP had built for domestic water. At the time, the GP was also using water from the well to irrigate community land (see well #3 on Figure 10.7). Unfortunately, in 1977 this well went dry, so most households reverted to using the traditional system of narrow dug wells. At that time the water table was higher than it is today, so they were able to access water from these dug wells by using a bucket and wooden wheel. Those who did not have private dug wells used a traditional well in the center of the village.

In 1982, the first government drinking water scheme was built in Kikwari. It consisted of a stone and concrete well (90 feet deep and 20 feet in diameter) with an electric motor that pumped water to a 30,000-liter overhead tank. The water from the well (well #1 on Figure 10.7 and Figure 10.6) is pumped 650 m by a five-horsepower electric motor through a 2.5-inch steel pipe which then conveys it through a 3.5 inch PVC pipe to the overhead tank. For the past 25 years it has operated as the main drinking water source for the village, releasing water twice a day simultaneously to all households.

**Figure 10.6 Old drinking water well that feeds the 30,000 liter tank**

Photograph by Monique Mikhail.

**Figure 10.7 Schematic of Kikwari village**




Courtesy of BSS, Kikwan's Support Organization.

**Figure 10.8a Pumphouse for new scheme**


Photograph by Monique Mikhail.

When constructing the scheme, the water was tested to determine the necessary chemical treatment. One community member was trained by the Department of Health to collect a water sample during each rainy season and take it for testing at the district hospital lab. The community adds 150 g of TCL powder daily into the 30,000-liter tank. Water treatment costs are covered by the water tax fund the GP collects for service.

All residents had access to one of the eight public taps, requiring payment of a monthly maintenance fee. If a household chose, it could pay a higher sum of INR 360 per year ($8.17) for a direct connection between the main distribution line and residence. In total, 73 households are paying for pipe connections. Once the domestic water needs for the day were met, the remaining water was piped to a four-acre community plot. For private farmland, farmers used their own wells to irrigate.

**Figure 10.8b 50,000 liter tank for new scheme**

Photograph by Monique Mikhail.

However, community members soon realized that water distribution was very uneven. The high discharge to the private connections caused the pressure to drop and lowered the discharge from the public taps. And households that had chosen a one-inch pipe direct connection were receiving more than those that had a three-quarter-inch pipe direct connection. To get around the imbalance in distribution, some households had actually connected pumps directly to the mainline to increase their access to water. All of these inequities caused a great deal of conflict. But prior to 2000, the community was unorganized. Once they started working together on the Soil and Water Conservation Program and Sanitation Campaign, they realized that they could work together to better manage the domestic water system. Thus by 2002 the community voted to restrict the discharge from the private connections. To accomplish this change, they first adjusted the household connections by moving them outside of each house. Then Mr. Kakulate envisioned a creative solution based on his knowledge of drip irrigation: a section of pipe at the entrance of each direct connection was replaced (originally 20–25 mm diameter) with more restrictive 8 mm tubing. The distribution time was fixed at two hours each morning and evening. Since the diameter and length of the pipes and timing of access were the same for each household, a more equitable distribution of water was established. The flow to directly connected households was reduced, and the pressure and flow to the public taps increased.

In 2000 the community realized that while the households in the village settlement all had their own water storage, tribal households did not. This made them more vulnerable to water shortages and power cuts. Therefore, the community decided to build a 100-liter storage tank in the tribal area. The overflow from the tank is directed to the old, dry community well (well #3 on Figure 10.7) to recharge groundwater. An extra hand pump for the tribal area was also installed as backup when the tank was empty.

## THE JALSWARAJYA PROJECT

By the time the Jalswarajya Project was begun in Nasik in 2005, Kikwari was already heavily involved in their water resource management and sanitation activities. Considering that ensuring sufficient drinking water was the instigating factor for their incredible work thus far, they were no less interested in obtaining a new drinking water project from the state to augment their previous system. Although the Jalswarajya project is designed to supply only drinking water, Kikwari is creatively combining the previous drinking water system with the Jalswarajya scheme to cover both their drinking and productive-use needs.

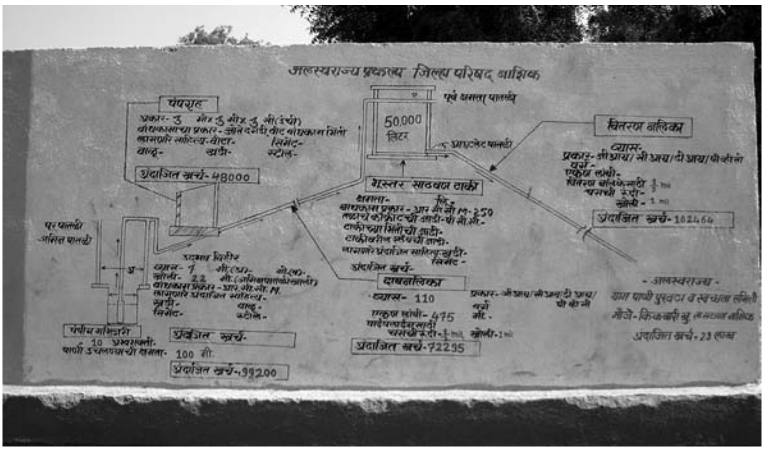
When the Jalswarajya Project started, the Village Development Officer (VDO) received information about Jalswarajya from the Block Development Officer. The VDO passed this information to the GP, who explained the requirements and application procedure to the villagers. In their application they explained that while their water resource work had strengthened the groundwater supply, the existing well and overhead tank were still insufficient for their needs. They still suffered scarcity in times of drought. Since sanitation work and water source strengthening work are prerequisites for receiving a Jalswarajya project, and Kikwari had been so successful at both, they were quickly selected to receive a project.

Once they were selected, the Jalswarajya Project gave the GP committee training on how to select a local NGO to be their support organization (SO) and technical service provider (TSP) to design the system. They also had to select a contractor to actually build the water system that the TSP designed. The SO, TSP, and contractor were chosen from a predetermined Project list. Four local NGOs came to the village and pitched their organizations to the villagers. They explained the kind of support they could provide to the community. Kikwari selected Baglan Seva Samiti (BSS) largely because of their proximity to the village.

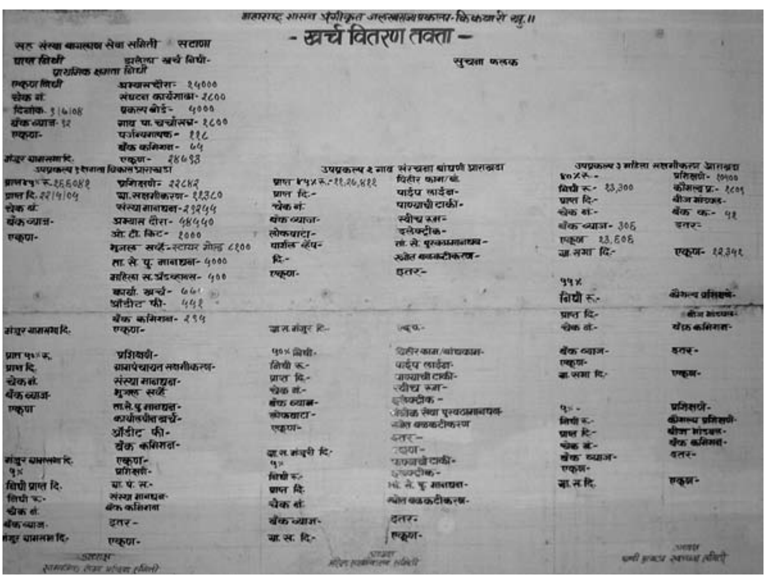
BSS first performed a participatory rural appraisal. The community delineated their current water system and explained their need for the future system. Second, BSS also worked with the community to form the three designated committees—Village Water Supply and Sanitation Committee (VWSC), Women Empowerment Committee (WEC), and Social Audit Committee (SAC) (all described in chapter 9). Third, BSS helped the VWSC negotiate terms with the TSP and contractor of the water scheme.

**Figure 10.9a (Top) Water balance drawn on building wall**

**Figure 10.9b (Bottom) Scheme budget information with expenditures**




Photograph by Monique Mikhail.




Photograph by Monique Mikhail.

Finally, BSS gave the results of the participatory rural appraisal to the TSP. The TSP then surveyed the village and surrounding area to plan the scheme: how the pipelines should be distributed, the overhead-tank capacity needed, etc. In order to determine the tank capacity required, the TSP took the projected 20-year village population and multiplied by 40 liters/capita/day. Assuming that the tank would fill twice per day, the tank design most suited to the need was selected from a preset Project list.

For Kikwari, the TSP selected to build a new 50,000-liter tank (Figure 10.8b), a new 30-m deep well (well #4 in Figure 10.7), and pumphouse (Figure 10.8a/Plate 16) to supplement their existing drinking water system. Water will be pumped from the new well through 600 m of PVC pipe to the new 50,000-liter tank. Each household in Kikwari will receive a direct household connection with a 10 mm offtake (see Figure 10.11) from the new tank. Water will be distributed to each of the five designated village zones equally on a timed rotation. The community could have chosen to use their preexisting distribution system for water from both tanks. However, the previous drinking water system was already 25 years old and the pipes sometimes leak. The additional volume of water would place undue stress on the old distribution network. Since they were offered a new distribution system with direct connections as part of the Jalswarajya Project, they thought that they would lose less water through leakage from the new system and prevent the need for constant repairs.

In order to save water, they are installing an automatic switch to stop the pump once the tank is full and fitting each household connection with a press tap (it must be pressed in order to release water, thereby preventing leakage and waste). And to protect their water sources, they are planning to cover all wells to keep out rainwater runoff and other contaminants. As part of Jalswarajya requirements, Kikwari was required to collect 10 percent of the project costs in cash and labor contribution from villagers. Group members call BSS on an as-needed basis, usually to assist in documentation of the scheme progress.

The total cost of the Kikwari project was projected to be INR 2,803,460 ($70,086) on completion. Therefore, the per capita cost will be INR 1,580 ($39). For operation and maintenance costs, the community decided to charge INR 75 ($1.80)/capita/year for wealthy and middle-income members and INR 60 ($1.50)/capita/year for low-income members. They have not yet planned the water-treatment regimen for the new tank. As a way to create transparency in the project, the water balance and expenditures are written on the wall of a public building in town. These can be seen in Figures 10.9a and 10.9b.

## INCORPORATING MUS

When IDE began working on MUS in Maharashtra, one of the first steps was to determine which communities were already using systems as de facto

MUS. Staff had heard about Kikwari and their exemplary Soil and Water Conservation Program and Sanitation Campaign work and were interested in establishing a relationship with the village. IDE staff requested information about Kikwari from BSS during their participatory rural appraisal activities to determine whether or not Kikwari might be a good village to approach for MUS. Staff visited the village and met with Mr. Kakulate, the GP chairman, the Village Development Officer, and other villagers. Ultimately IDE staff determined that with Kikwari's water resource management history and willingness to try new technologies and approaches, the village would be a perfect fit for adding a MUS component to their Jalswarajya scheme.

To initiate MUS work in Kikwari, IDE staff first met with the whole VWSC and other villagers in January 2005 to introduce the concept of MUS and assess community interest in establishing kitchen gardens with drip irrigation kits. They discussed the advantages of the irrigation kits, instructions for use, care and maintenance, and the cost of the kits, and they demonstrated their use. The community displayed keen interest in introducing this component along with their other work. They reasoned that with the addition of the new infrastructure, there would be sufficient water for fulfilling their domestic needs, and additional water could be used for productive purposes.

In the three months following this initial meeting, IDE staff visited Kikwari twice a month to attend VWSC meetings, discuss the progress of the Jalswarajya scheme, and plan for the MUS component. As part of the plan, they determined the number of households that would have space for a kitchen garden, how much community land they wanted to irrigate, and the number of livestock they needed to water. In Kikwari most of the houses are very close to one another, so space for kitchen gardens is limited. However, due to the very small space and water requirements of IDE's kitchen garden kits (20 $m^2$), 150 households are installing kitchen gardens.

As the Jalswarajya project progressed, BSS worked with women to form five Self-Help Groups (SHGs) in the village, teaching them how to keep bank-account records. One SHG is much more active than the other four[3], and in 2004 the GP contracted out four acres of community land to them for INR 9,000 ($221). The SHG cultivated wheat and earned a net income of INR 12,000 ($294). Due to this success, the SHG again leased the land in 2005, choosing to grow sugarcane instead of wheat because of the higher returns. This gave them a net return of INR 105,000 ($2,574) for the group. In 2006, they again grew sugarcane with a similar return. In 2007 the GP decided to lease the SHG eight more acres of community land, for a total of INR 65,000 for all twelve acres. The group shifted the four previous acres to growing pearl millet in the *kharif* (winter) season and wheat/maize in the *rabi* (summer) season. They then planted the eight new acres with sugarcane (see Plate 17). To irrigate this additional community land, the community used some of the award money to build a separate pipeline to the fields from well #1. And with the source-strengthening activities in the village and the

**Figure 10.10a Tribal area with goat farm**

Photograph by Monique Mikhail.

**Figure 10.10b Tribal families tending goats**

Photograph by Monique Mikhail.

return of heavy rains, there is enough water in the existing well to use excess water to flood irrigate these plots. Despite the availability of sufficient water for flood irrigation, the community wishes to conserve water. Thus, the SHG is now planning to drip irrigate the community plots.

One other SHG is starting to become more active, and in January 2007 the women began a catering business for the five nursery schools and one K–7 school in Kikwari. They use excess water from the 30,000-liter tank for their business and are receiving payment from the Zilla Parishad for this work.

Again, the community recognized the relative poverty of the tribal households and drafted a plan to increase their income. Households that own their own farm generally keep livestock at the farm, but tribal households do not have their own farms. Therefore, the GP constructed a goat farm near

**Figure 10.11 Two different household connections with the new scheme**

Photograph by Monique Mikhail.


the tribal households (just outside the village settlement) where they keep mostly goats, but also cattle (see Figures 10.10a and 10.10b /Plate 18). These households keep their own goats and are paid to look after the goats of some nontribal households. The manure is composted and sold as fertilizer to farmers. Previously, the drinking water supply was not ample enough to water their livestock, so they either used a portion of their household water or used river water. Now that the new system has just been completed, they receive water for their goat farm from the previous drinking water system's 30,000-liter tank.

Now that the new drinking water scheme has just been finished, the community uses the new 50,000-liter tank and well for drinking and other domestic purposes. The old drinking water system's 30,000-liter tank is used

**Figure 10.12 Community tree planting**


Photograph by Ratnakar Pawar.

to supply all productive needs including village plants, the community plots, the goat farm, and other activities. Households that have space are just now beginning to install backyard kitchen gardens with drip irrigation kits. The productive-use water is distributed through the old pipelines. The 8 mm tubes will be used as the irrigation offtakes at each household for their kitchen gardens (see Figure 10.11). This is in essence creating two separate water supply systems for each household: the new system is used for domestic purpose, while the preexisting system is used for productive use like kitchen gardening, horticultural plants, and flowers near the houses. And although there are already some fruit and nut trees and flowers planted (Figure 10.12) along village streets, more are planned. The community will irrigate these plants with drip as well, and the produce will be consumed by all community members. If any household is found to be using water in excess of their allotment by the VWSC for productive use, the VWSC will decide whether this use is acceptable and, if so, what to charge the household for the extra supply.

## OUTCOMES

Considering that the system construction has just been completed and MUS activities are still underway, it is impossible to provide outcomes specifically from MUS at this time. However, villagers expressed outcomes and impressions from all of the village efforts over the past several years, which have relevance to MUS. In general, previous successes have raised community morale and encouraged continual improvement of the village through innovative water-management efforts.

### IMPROVED HEALTH

According to a group of about ten young men who were standing on a village street during the April visit, the main benefit in the village was a decrease in disease. A village doctor echoed their sentiments by stating that he'd seen a decrease in disease outbreak in the village over the past five years. He declared that malaria had decreased because of fewer mosquito-breeding opportunities. Tuberculosis and bronchitis cases have also diminished. A decrease in the number of flies was also reported. One of the members of the SHG that is farming community land explained that there was a Chikungunya[4] disease outbreak last year in the whole region. Although residents of several neighboring villages fell ill, not a single person in Kikwari got sick. She believes that they were not susceptible to the disease because of their high level of base health. However, it is also likely due to the decreased number of mosquitoes. The use of direct household connections instead of public taps,[5] the new drainage system and wastewater treatment have all helped bring about this decrease.

### INCREASED CONFIDENCE FOR WOMEN

The six female members of the SHG who are farming community land declared that working with the SHG has given them confidence. They feel that by working together, they can accomplish more. This feeling has motivated them to become more active in their community in general. They are enthusiastically beginning new projects together and strengthening the group.

### RAISED COMMUNITY PROFILE

Through all of their efforts, Kikwari has become well-known in the area as a model village for water resource management. This has had a positive effect on the morale of the community. The pride they feel in their village only motivates them to initiate new community projects, building on the momentum of past development. While taking a tour through the village, IDE staff met with visitors from a neighboring community who had come to see the work in Kikwari to inform their own village water work. They were impressed with all the village had done and wanted to emulate their success.

## CONCLUSIONS

The clearest lesson that comes through the Kikwari case is the importance of a lead figure in mobilizing a community to take control of managing their resources in a creative way. Without the ingenuity and passion of Mr. Kakulate, Kikwari would be a very different place today.

But even with all of the village improvements, the stratification of the village has not completely changed. There is still evident disparity between

**Figure 10.13 Self Help Group member flood irrigating the sugar cane plot**

Photograph by Monique Mikhail.

the tribal households who are the most disadvantaged and other villagers. Although water resource efforts have clearly helped all Kikwari residents through public-health improvements and productive-use possibilities, the efforts appear not to have addressed the residents' economic inequality in any significant way. However, all of the tribal households as well as many others are installing and beginning to cultivate kitchen gardens with drip irrigation near their homes. Perhaps once the kitchen gardens are operational, it will help some of those with less access to land raise their income.

Despite some efforts to shift toward horticulture and use microirrigation, the importance of shifting away from cultivating water-intensive crops seems not to outweigh the economic drivers. Despite the severe drought a few years back and the extraordinary efforts at groundwater recharge, there has not been much of a shift in crop cultivation: sugarcane remains the major cash crop. Although the women grew wheat on the community plot in their first year, they quickly shifted to sugarcane once they knew that the water was available (see Figure 10.13). There are many factors that encourage sugarcane cultivation. Not only do the people already know how to grow it, but they receive much higher profits than from other crops. Lack of readily available farm labor in the area is another limiting factor. The young men in the village do not want to farm, and all others are already farming. The women's SHG said that they contract with the local sugar factory before harvest. The factory sends a harvesting team, pays the SHG for their product, and takes it away to process it. This not only helps eliminate their need for additional labor and transport, but it reduces the risk of not being able to sell the full crop. Unfortunately, sugarcane is an extremely water-thirsty crop. The fact that they are cultivating it despite recent water problems indicates that there is inadequate community water budgeting, insufficient incentives for judicious use of groundwater, and no penalties for excessive use. This may have been due to a lack of knowledge transfer from BSS, whose responsibility it was to train them in water conservation. Unfortunately Jalswarajya does not pay SOs well[6], and their income is often not enough to pay for the transportation required for frequent visits to the community. Although Kikwari was very organized and seemed not to need the assistance of their SO as much as other communities with Jalswarajya schemes, it may have hurt them to some extent. Or community members may feel that water is no longer a problem due to recent water abundance and the Jalswarajya scheme. Ultimately, the shift to less-water-intensive crops must be encouraged from the state government level. Currently the incentives to grow sugarcane are too high for many to resist.

Another issue that Kikwari needs to address is water treatment. It may not be cost effective for them to treat productive-use water. If the 30,000-liter tank is used solely for productive uses, treatment for that tank will not be necessary. However, if future population growth necessitates combining some of the water from the old system with the new Jalswarajya scheme for domestic uses, treatment will need to be resumed. The VWSC should create a plan for water testing and treatment.

Kikwari is an excellent example of a community that integrated its water-use needs on their own and used several limited government programs to overcome scarcity and achieve community water-use goals. Although the Jalswarajya project did not specifically include productive-use water in its plan, Kikwari was able to combine it with its existing system to allot water for each need, using one tank for domestic water and the other for productive use.

Due to severe water scarcity in certain years, Kikwari must plan allocation among various uses, mobilize resources from several sources, and utilize water efficiently (like the use of greywater for community agriculture). Through working together, they gained consensus among all users to equalize distribution and incorporate all users' needs. Although neighboring communities will need to devise their own strategies for their own unique water resource situations, the greatest lesson they can learn from Kikwari is that community mobilization, cooperation, adaptation, and innovation are needed to achieve the desired water-management results.

CHAPTER 11

# SAMUNDI: WOMEN LEAD THE WAY

Photograph by Monique Mikhail.

Samundi was chosen as a case study in Maharashtra to represent an incredibly motivated tribal community that is using the Jalswarajya project to supply all their water needs. Theirs is a unique story of village women taking charge of their community's development. Background information for the case study came from interviews with IDE field staff who have worked and continue to work with Samundi community members throughout the Jalswarajya scheme construction. Field staff collected information from the participatory rural appraisal conducted by Adhar (Samundi's SO through Jalswarajya), met with Adhar and Vachan (another local NGO working with Samundi on a separate horticulture project), the president of the VWSC, and the VDO to collect information on the community. The remaining information was collected during a visit of international and national IDE staff during April 2007, during which the following meetings were held:

- Village tour by Women Empowerment Committee chair
- Conversation with tank contractor and a few village laborers working on tank construction
- Conversation with Women Empowerment Committee chair and another committee member
- Group interview with the VWSC chairman, one other VWSC member, one Gram Panchayat member, and one landless-community farm laborer
- Interview with Adhar staff member assigned to Samundi village

## SITUATION ANALYSIS

### COMMUNITY SETTING

#### Location

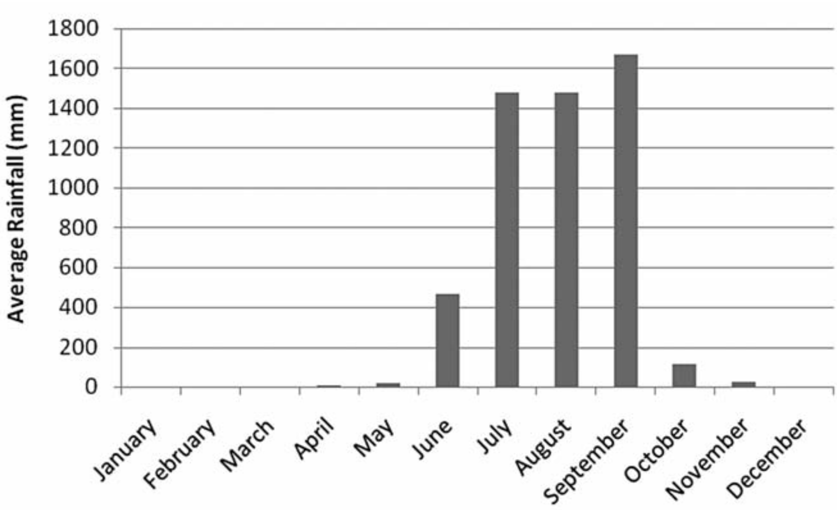
Samundi village is located in Trimbakeshwar Tehsil of Nasik District in Maharashtra. It is located about 40 km southwest of Nasik city and 14 km from Trimbakeshwar. There are all-weather roads providing easy access to Samundi village by bus or private vehicle.

Samundi is in a region that has very heavy rainfall during the monsoon and almost no rain for the remainder of the year, providing a feast-or-famine situation. The rainfall pattern can be seen in Figure 11.1. The environment at the beginning of the dry season can be seen in Plate 19.

#### Population/Demographics

There are 120 households in Samundi, totaling a population of 759. Of these households, 114 are tribal. Ninety-five percent of the people are from scheduled tribes (Mahadev Koli), 2 percent are Katkari (Scheduled Caste), and 3 percent are other castes.

Figure 11.1 Average rainfall in Samundi




Rainfall data from Trimbakeshwar observatory.

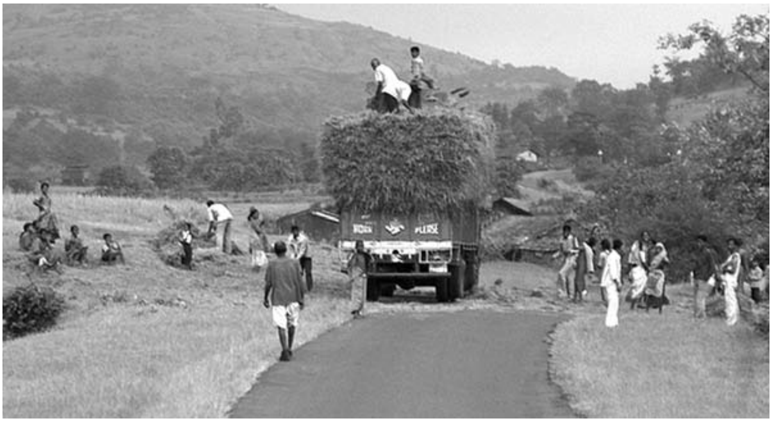
### Socioeconomic Situation

Ninety-eight percent of the population is engaged in agriculture. Villagers who do have land have 1–10 ha. A few individuals have service jobs or do carpentry or masonry, and there are three shopkeepers and *paan*[1]-stall vendors. Food requirements, education, clothing, and healthcare comprise 70–80 percent of total expenditures. Some farmers use a portion of their land to grow grass in the rainy season, keeping some as fodder for their animals and selling the rest (see Figure 11.2). As is typical for a tribal village, 73 percent of the population lives below the poverty line (about INR 20,000 per year—$490), and the literacy rate averages 68.6 percent.

## INITIATING CONTACT WITH THE COMMUNITY

After the first MUS Learning Alliance workshop (discussed in chapter 13), IDE staff worked with the Nasik District Jalswarajya office to review the villages implementing schemes and find those that might be a good fit for MUS. The SO for Samundi village, Adhar, was a local NGO with whom IDE had a previously developed relationship. Hence, IDE arranged with Adhar to receive information from the participatory rural appraisal they had conducted and then visited Samundi, which was 40 km from the IDE office in the city of Nasik. At this first visit, it became evident that Samundi had scarce water resources, and villagers had to walk long distances to obtain drinking water. Additionally, the village economy was dependent on agriculture, growing mostly rice and wheat, but no vegetables. Most of those below the poverty line were landless laborers or those who leased a small amount of land from other farmers. Yet despite these disadvantages, the community had already shown

**Figure 11.2 Sale of grass for fodder in the rainy season**




Photograph by Ratnakar Pawar.

great initiative in improving their village, using their own resources and mobilizing government projects. Based on all of these factors, IDE realized that Samundi would be a good fit for MUS.

At the initial visit, IDE staff met with all VWSC members and other villagers to discuss the concept of MUS and the way multiple uses might be incorporated into their Jalswarajya project. The idea of kitchen gardens with drip irrigation kits was discussed and demonstrated including advantages, care and maintenance, and cost. Although Samundi was very water scarce, they felt that once the new Jalswarajya scheme was installed, there would be enough water for drip irrigation of small kitchen gardens.

## SAMUNDI VILLAGE DEVELOPMENT

Samundi's story is an extraordinary one for many reasons. About six years ago Samundi village was unorganized, and there were multiple disputing factions within the community. It was very dirty with trash strewn around the village. There were 14 local liquor manufacturers producing 200–250 liters of liquor per day that was sold within the village. High rates of alcohol consumption translated into high rates of crime. Fights would break out often, and women were often victims of abuse. As the villagers explained, "there was liquor, but not water to drink." The government was of little help because no government officer would dare come to the village after 4:00 p.m.

A Mr. Dixit who lived in a nearby village helped to organize the women in the community into a group called Mahila Mandal. In 2002 these women fought the liquor manufacturers and established prohibition in the village. And with the success of their prohibition efforts, women realized that they could be a force for change in their village. They began seeking out local NGOs to assist them in development activities. These projects included building dirt roads, picking up trash, cleaning the drainage system, and planting trees.

It was about this time that the state of Maharashtra was in the midst of the previously mentioned four-year drought. During the drought, Samundi villagers only had an average of 5 liters/capita/day of water in the summer and 20 liters/capita/day in other seasons. During the four summer months their only means of obtaining domestic water was from tankers that came to the village. Thus, the Samundi women decided that they needed to do something about their water situation.

**Figure 11.3a and b  Community reforestation efforts**

Photographs by Ratnakar Pawar.

## SOIL AND WATER CONSERVATION PROGRAM

Mahila Mandal learned of the statewide Soil and Water Conservation Program and began planning. They sought the support of Vachan, a local NGO, who worked with all villagers in 2003–2004 to shift previous community grazing land into a 24-ha forest. The community planted trees and maintained the forest (see Figures 11.3a and b). They also placed a ban on tree cutting, fining violators INR 501 ($12). If villagers needed lumber for house construction, they were required to replant ten trees at minimum. With village labor they constructed three small check dams on the nearby stream for groundwater recharge. They constructed recharge pits (three feet wide and three feet deep) at each household for groundwater recharge. They then dug a community well on the outskirts of the village that was fed by water from a nearby pond. They hoped that this would make them less dependent on the tankers for drinking water.

## SANT GADGE BABA VILLAGE SANITATION CAMPAIGN

Samundi villagers began their sanitation efforts concurrently with the Soil and Water Conservation Program. In 2003, with the help of Vachan and Adhar (another local NGO), villagers contributed labor to clear the roads of trash and weed out invasive plants. Individual households constructed latrines, with the goal to have latrines in all households. Any household that was below the poverty line received an INR 1,200 ($29) subsidy from the Block Development Office to build its latrine. The total cost was around INR 2,000-($49). Some constructed their latrines inside the house (see Figure 11.4a), while others constructed them outside or near the house. Households that did not have sufficient funds took informal loans from Mahila Mandal, who had established a savings group through the government and had a revolving loan fund. Toilet facilities were also constructed for the village schools (see Figure 11.4b).

As part of the village sanitation project, open defecation was banned in the village, and the GP decided that violators would be fined INR 251 ($6). If someone sees a violator and does not report it, that person must pay a fine of INR 101 ($2.50). To date, only two people have violated the rule.

They also designed gravel soak pits at each household where wastewater from washing, cooking, and bathing drained from the house. This helped in the reduction of mosquito breeding because there were no longer stagnant pools of wastewater near the houses. In addition, all houses were painted and roads were repaired. With all of these efforts Samundi won the Tehsil-level first prize as well as prizes at the district and regional levels.

## PREVIOUS DRINKING WATER SITUATION

The existing drinking water availability before Jalswarajya was not ideal. There were two hand pumps (only one of which worked in the dry season) and one dug well 1.5 km from the village with a bucket and rope to draw water (see

**Figure 11.4a Newly constructed toilet inside a house.** Photograph by Monique Mikhail.

**Figure 11.4b Toilets for the village schools.** Photograph by Ratnakar Pawar.

Figure 11.5). The hand pump that works year-round has a low discharge in dryer months, taking about 30 minutes to fill two 20 liter containers (see Plate 20). For a family of four, it would take two hours just to get enough domestic water for the day. However, this was easier than the half-hour walk each way to the dug well. One woman can reasonably carry three containers of water, so it would take two to three hours to fetch water from the well for domestic needs. With water in such short supply, long lines would form at the pumps, and disputes would arise over how many buckets an individual was taking, the length and order of the line, etc. Since there was no formal limitation on water quantity that a person was allowed to take from the tap, the community created informal rules. One person was limited to drawing two buckets at a time to try and ensure minimum needs were met.

There are also six private wells in the village that belong to wealthier households. They do share the water with villagers if there is not enough at the hand pumps. However, during the drier months all of these wells are low. Most of the livestock (cattle, goats, and sheep) get water from the nearby streams. Some households water their livestock near the wells.

## THE JALSWARAJYA PROJECT

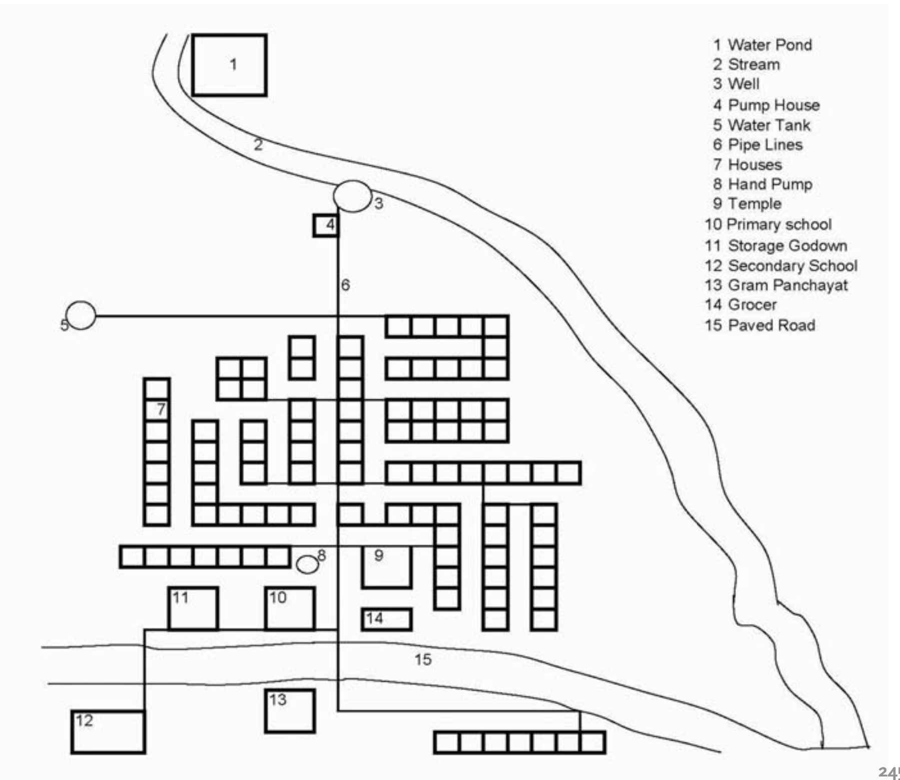
At the same time that Samundi was engaging in the Sanitation Campaign, the Jalswarajya project was initiated. Considering that both the Soil and Water Conservation Program and the Sanitation Campaign were prerequisites for being selected for a Jalswarajya project, Samundi had a good chance at selection. However, they were only beginning their sanitation efforts. As part of the agreement for the Jalswarajya project, they were given one year into their Jalswarajya project to complete their sanitation efforts.

## Starting the Project

In 2005 Jalswarajya was initiated in Nasik District and the Project put out a call for villages to apply. They sent a letter to every GP and also put advertisements in the newspaper so that communities could approach independently. The Samundi Village Development Officer and GP had a meeting with Mahila Mandal in Samundi to discuss whether they wanted to participate. Samundi decided that they were definitely interested and applied to be short-listed for the project. Three months later they received a letter from Jalswarajya that they had been accepted. Jalswarajya staff visited Samundi to explain the project conditions, and a formal contract was signed by the GP chair.

Next, Samundi interviewed a few local NGOs to determine which one they wanted to be their Support Organization. They chose Adhar to be their SO because it was the only local organization that had female staff, and they worked with women's groups in other neighboring communities. Once Adhar

**Figure 11.5 Samundi schematic**




Courtesy of Adhar, Samundi's Support Organization.

was chosen, they helped the community form the three groups required of a Jalswarajya project—the Village Water and Sanitation Committee (VWSC), Women Empowerment Committee (WEC), and Social Audit Committee (these are explained in more detail in chapter 9). The VWSC in Samundi has 17 members including a president and secretary. The WEC has 16 women with a chairwoman and secretary. Adhar is responsible for training the WEC to be trainers for the remainder of the community on health issues and appropriate water use. All three of the committees bring concerns to the whole community, and the community is responsible for ratifying final decisions. But it is the Village Development Officer and VWSC chair who are jointly responsible for funds given by Jalswarajya. These funds are given in installments based on the project estimate drawn up during the detailed survey.

Once the three committees were formed, Jalswarajya gave the VWSC INR 25,000 ($613) for village visits to "model" locations so that Samundi could see the projects in other communities. At this time the community had to choose a Technical Service Provider (TSP) to design the system, either a private or government consultant. After visits to "model" villages, the VWSC met four times with Adhar and the TSP to conduct the participatory rural appraisal and determine what kind of project the community needed. Adhar gave the VWSC training on trash disposal, village sanitation/cleanliness, water conservation, and judicious water use.

At the same time, the WEC received their own funding of INR 10,000 ($245) for educational activities and INR 33,000 ($809) for starting an enterprise. They used most of this money for trainings and workshops. Training organizations and costs for trainings were predetermined by the Jalswarajya project; the WEC was merely responsible for choosing the NGO and paying them accordingly. Upon the recommendation of Adhar, the WEC chose the organization Josepha to provide vocational trainings on *papad*[2] making, pickle making, incense-stick production, chalk making, dairy, and poultry raising.

After the trainings, Josepha was supposed to help the WEC organize their bank loan to begin a small-scale enterprise. However, according to Adhar, Josepha failed to fulfill the remainder of their obligations to the community. Previous loans Mahila Mandal had received for work they were undertaking with Vachan had not yet been fully repaid. So there were complications on establishing a bank loan for the new enterprise. The bank Josepha had approached refused the loan, and Josepha did not seek other sources. Adhar admitted that they also did not follow-up with Josepha as well as they should have, and the WEC enterprise has faltered because of it.

## Financing the Project

At this point the TSP performed a detailed survey of Samundi and created the water scheme design and cost estimate. Because it is a tribal community, Samundi was responsible for contributing only 5 percent of project costs; it chose to contribute 4 percent in labor and 1 percent in cash. According to the estimate, Samundi got the first installment of INR 500,000 ($12,254) for well construction, excavation of the pond, and purchase of pipes. The second installment was INR 599,000 ($14,681) to purchase pumps, finish the pump house, build the storage tank, and connect the pipes to the village. The Jalswarajya Project monitors how the money is spent. If the VWSC spends more than the initial estimate, Jalswarajya can choose whether or not to supply the extra financing. Money allocated for a particular component (for example, the tank) is meant only for that component. The proposed cost estimates the TSP came up with are shown in Table 11.1.

**Table 11.1: Jalswarajya scheme costs**

| Component of scheme | Cost (INR) | Cost ($)[3] |
|---|---|---|
| Well | 218,526 | 5,356 |
| Pump house | 29,088 | 713 |
| Pumps | 89,064 | 2,183 |
| Intake main line | 90,757 | 2,224 |
| Overhead tank | 248,008 | 6,079 |
| Distribution lines | 226,111 | 5,542 |
| Water source strengthening (pond excavation) | 208,082 | 5,100 |
| Covering open drainage canals | 200,000 | 4,902 |
| Extra costs | 68,000 | 1,667 |
| Total | 1,377,636 | 33,766 |

Source: VWSC data.

## System Design

As planned by the TSP, the existing dug well would be renovated by deepening it to 50 feet and lining it (Plate 21). A pump house would be built to store two working three-horsepower pumps and one extra pump to use as backup if there are problems with one of the other two. A 50,000-liter overhead tank would be constructed, and a 500 m-long PVC pipe would deliver the water from the well to the tank. The tank was expected to fill twice per day. Underground drainage lanes would be constructed along with the water supply scheme.

Originally tapstands at every street corner were planned for distribution purposes. But some in the community were interested in household connections, so the community voted on whether or not to provide everyone with direct connections. The community decided to build the direct connections. In the WEC chairwoman's opinion, household connections will encourage more responsible water use because people will be less likely to leave the water running. It also will create more equitable distribution, reducing water conflicts. Additionally, with home connections they will be responsible for water taxes (INR 450/household/year—$11). With water taxes, the VWSC will be able to shut off a household's connection if taxes go unpaid. This management mechanism will ensure better system payback for operation and maintenance requirements.

Once construction began, the design for the tank was reduced from 50,000 liters to 26,000 liters to reduce costs, so the distribution plan was adjusted to suit the new tank size. Figure 11.6 shows the construction of the 26,000-liter overhead tank. Water will be distributed to four different zones in the village. Each zone will receive water for one hour twice per day. However, the timing will depend upon when the power is available for pumping. The village currently undergoes eight hours of load-shedding per day.

**Figure 11.6 Construction of the 26,000 liter overhead tank**

Photograph by Monique Mikhail.

**Figure 11.7 Pond adjacent to drinking well after excavation**

Photograph by Monique Mikhail.

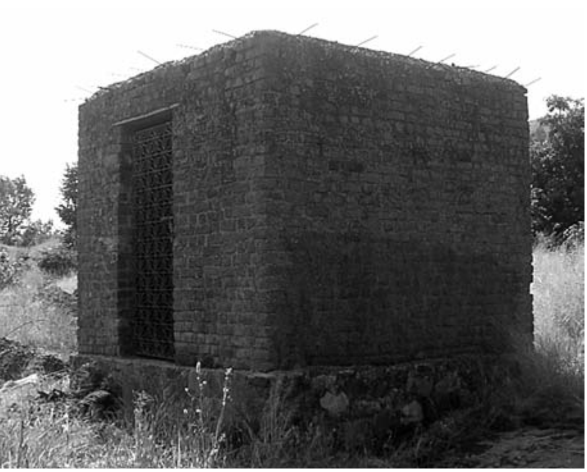
Along with construction of a new drinking water system, Jalswarajya encourages the continuation of the Soil and Water Conservation Program through a component of the project called "source strengthening activities." For these activities the community chose to excavate the pond (see Figure 11.7) to increase its storage capacity and recharge the groundwater supplying the nearby dug well. They removed 5,000,000 kg of silt to restore the pond's original 30-foot depth. This dredged silt was spread on the edges of the pond and on neighboring farmland.

## System Construction

Once the system was planned, three separate contractors were hired for system construction. The VWSC provided the well contractor with the necessary materials, and he is constructing it himself, charging the VWSC the local labor rate. For the pond excavation, the pond contractor brought in equipment and paid villagers on an hourly basis for their labor. For the tank and pipelines, the VWSC bought the pipe and other necessary materials; the tank contractor hired villagers for unskilled labor at an hourly wage and skilled labor from outside the village. For all of the labor, villagers received an hourly wage of INR 100 ($2.45) for men and INR 80 ($1.96) for women. At this stage the system construction has been just recently finished. The VWSC was unable to pay for the full well deepening and construction from the expenses given to them by Jalswarajya and had to borrow from the source-strengthening funds to finish the well.

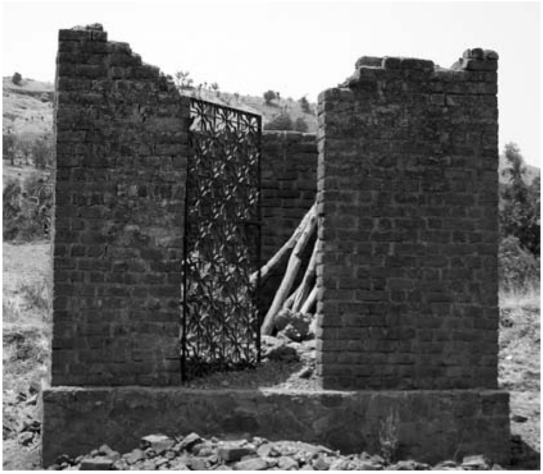
The community originally wanted to build the well and pump house itself to save on contractor expenses. But a large portion of the pump house broke soon after being built, and the community has had to bring in a contractor to fix it (see Figures 11.8a and b). The WEC chairwoman said that this experience taught them the importance of not taking short cuts to getting the proper construction work completed.

Figure 11.8a Newly constructed pump house



Photograph by Ratnakar Pawar.

Figure 11.8b Broken pump house



Photograph by Monique Mikhail.

## Operation and Maintenance

Once the scheme is completed, an operator will be hired. The operator will be responsible for operating, controlling, and maintaining the pump sets as well as reporting to the VWSC if any problems occur. The water tax mentioned above will be used to pay the electricity bills for pumping. Any remaining money will be kept in a maintenance fund. Whenever additional funds for operation and maintenance are required, they will be collected from users by the VWSC at that time. Three of the village youth were also sent to the Industrial Technology Institute[4] in Nasik city to be trained on masonry and operation and maintenance of the scheme. They will assist the operator.

## INCORPORATING MUS

After IDE's first visit to Samundi in January 2005, IDE staff visited the village 15 times in the next three months. They participated in VWSC meetings, discussed MUS with villagers, and assessed the potential for MUS work within the Jalswarajya project. The number of families with space for kitchen gardens and the community land they wished to irrigate was determined. The primary school is planning to drip irrigate a kitchen garden on its land to provide vegetables for the children and to demonstrate drip irrigation of vegetables to the whole community. The community is also planning to use the community land around the temple to install a garden irrigated with drip lines.

Since the Jalswarajya project was designed for the projected village population in 2020, there is currently excess water for productive use. IDE staff discussed the choice of increasing the pipe diameter to deliver a larger volume of water to homes, but the community decided it would rather run the system for a longer period of time during each distribution instead of increasing the pipe diameter. Households also decided to use domestic wastewater for irrigating the kitchen gardens.

It was agreed that as soon as the Jalswarajya scheme was completed, villagers would purchase the drip kits and Adhar would train them on how to install, operate, care for, and maintain the kits. IDE has already trained Adhar on their installation and use. One kitchen-garden drip kit can irrigate an area of 100 $m^2$ and costs around INR 500 ($12). Families can also opt to purchase a vegetable seed kit for INR 50 ($1.20) containing seeds of ten different vegetables (okra, spinach, drumstick, eggplant, gourd, tomato, onion, garlic, coriander, and papaya).

Since it is largely the women in the village who are responsible for kitchen garden cultivation, and the women are the primary motivators in Samundi, the idea was very popular. About 70 percent of the households have decided to install and cultivate vegetable gardens, using IDE's drip kits, for both consumption and extra income. Adhar will be training the community on kit use soon. The women also realized that they would not only have income from their produce, but would save money on the vegetables that they are currently purchasing from the market. Each household spends around INR 100 ($2.45) per month on vegetables. If they plant vegetable gardens, they can save INR 70 ($1.72) per month. Excess produce can be sold in the nearby market of Trimbakeshwar.

When discussing the extra income they could receive, the women in Samundi indicated several items they would spend the extra cash on:

- their savings group
- constructive village work
- education of the children (monthly fee for school books)
- medicine and healthcare
- clothing

Women stated that they were making virtually no income from their current agriculture (rice and *nagli*[5], only grown during the rainy season). Because of low returns on their crops, they sometimes do not have the money to pay their Mahila Mandal savings group dues for two to three months in a row. And the national cooperative bank in Trimbakeshwar will not lend to women's groups. They realized that the income from kitchen-garden vegetables would boost their household earnings. They also mentioned that most of the village youth were unwilling to assist in agriculture, so the fact that the women could grow the kitchen gardens on their own was favorable to them.

During a previous project with Adhar, 50 households in the village had planted mango and cashew trees on their own land (the total number of trees was roughly 540). These households will use pond water from the recently excavated pond to irrigate the trees.

## OUTCOMES

The villagers feel positive about the Jalswarajya project and pending cultivation of kitchen gardens. They are also incredibly pleased about the broader changes that have occurred over the last few years. The WEC chairwoman mentioned that crime has decreased dramatically and that the community is now able to resolve most disputes internally. She was very excited about the possibility of kitchen gardens because until now farmers have been limited to growing rain-fed crops. They could not afford to dig wells to irrigate their crops. She thought that using drip irrigation will allow them to cultivate with wastewater and a small amount of extra water from the domestic system.

### HEALTH AND INCOME

When the VWSC men were asked what the biggest benefit of the project will be, they agreed that health and sanitation were the most critical improvements. They believed that the increased availability of clean water and fresh vegetables would greatly benefit their health. They also commented about the increased cleanliness of the village from the Sanitation Campaign, which was already positively impacting health. Interestingly, although the men felt that improved health would be the greatest impact, the two women interviewed were most interested in the ability to increase income through sale of produce from the kitchen gardens.

### CAPACITY BUILDING AND COMMUNITY PROFILE

The community also felt that they had gained knowledge and improved their standing in the district through the series of projects. They described the increased awareness of water resource management and sanitation in the community. They outlined how their ability to work with outside groups and obtain resources from the government for community improvements had increased. And they were generally just proud of their village. Samundi is recognized as a model village by the government and has won awards with its efforts. They now have outside visitors coming to see their village.

### EQUAL BENEFIT

All those who were interviewed felt that the scheme would benefit rich and poor in the village equally because the "family nutrition" drip irrigation kits are cheap enough even for the poor in the village to afford. And although the 60 households on the village outskirts will have more space for the gardens, even the landless will be able to use them. One of the men interviewed was a landless farmer who said that he currently works other farmers' land and shares the produce with the landowner (80 percent to the landless farmer; 20 percent to the landowner). However, for such a small amount of land as is required for the kitchen garden, the landowner usually does not request any payment, allowing the landless farmer to keep all the fruits of his labor. Thus, although the landless farmers will be required to purchase their own kits, they will be allowed to cultivate and sell the produce for income.

### COMMUNITY INITIATIVE

When speaking with the staff from Adhar, IDE staff received very positive feedback about the community. Adhar is an SO for multiple communities through Jalswarajya and said that Samundi was unique in their experience: they were very cooperative and not laden with village politics. Adhar staff said that Samundi is a special place because even though they are tribal and the literacy rate is lower, the women are especially active and intelligent. When asked to take on a task, they would accomplish it quickly and did not always require Adhar's assistance. If they called a WEC meeting, all members were always present.

On the downside, there were a few problems. Adhar staff felt that the project had dragged on too long because of bad planning. It was impossible to work during the rainy season due to heavy rainfall, causing delays. There were also difficulties with documentation: monthly reports on activities and finances were not always completed on time.

## CONCLUSIONS

Although each Jalswarajya project is only meant to take 18 months, most projects are not completed in this amount of time. Samundi received an extension because the latrines took longer to construct than anticipated. However, even with a shorter latrine-construction time, it would have been impossible to complete the project within the designated timeframe. Jalswarajya does not factor in the nearly three-month-long rainy season, when it is next to impossible to work on construction. Clearly the planned project period should reflect reality more closely.

Additionally, the VWSC was unable to pay for the full well digging and construction from the money they were allotted and had to borrow from the source-strengthening funds. Although this is technically not allowed in the Jalswarajya project, there was no other way for them to come up with the money necessary to complete the project. Since the community is not responsible for determining projected costs but must work within them, Jalswarajya should create a process whereby the community can request extra funds if the TSP underestimated the required cost of a certain component.

The unfortunate situation with Josepha and lack of follow-up by Adhar to ensure Josepha's compliance with their responsibilities speaks to the payment mechanism of Support Organizations within Jalswarajya. The SOs do not receive enough funds to accomplish their important job. The SO receives the same funding regardless of project length or community need (only INR 70 or $1.72 per person in the community for the entire project period). This is a disincentive to work with the community beyond the bare minimum. For Samundi, Adhar only received a total of INR 8,400 ($206) for the entire project. And although Samundi is a motivated community, the people's lack of education meant that they required more help throughout the process than did other communities. Construction has been underway for two years and is not yet completed. Even with a fairly good local NGO like Adhar, the lack of adequate provision translates into fewer visits to the community and less follow-up than is necessary. In fact, when IDE staff were attempting to contact Adhar staff, Adhar explained that they had downsized due to inadequate funding. It took multiple tries to connect with the correct staff member. If it was difficult for IDE to contact Adhar, it must be even more difficult for the community to reach them when they are needed.

The importance of the roles of the SO and the training organization cannot be understated. When IDE staff visited Samundi, the WEC chairwoman expressed her excitement about the dairy they were planning to establish (if and when they receive a bank loan). When asked about the idea behind the dairy, the chairwoman explained that the Josepha trainer had really emphasized the concept of a dairy to the WEC and said that with the purchase of cattle, they would be able to make good income. This shows how impressionable the community is to the enterprise suggestions of the training organization. And although the women will undoubtedly continue trying on their own,

**Figure 11.9 Cattle watering at the drinking water well**

Photograph by Monique Mikhail.

the fact that Josepha abandoned the effort shows that not all training organizations appropriately use their power. The role of the SO, particularly in knowledge dissemination, is also critical. Although Adhar provided training on water management, it is unclear whether they educated the community about water quality and source protection. As seen in Figure 11.9, IDE staff saw cattle watering at the drinking water well during the field visit. Although the well is under construction and will eventually be lined, it is still the current drinking water source for villagers. The possibility of livestock feces contaminating the well and the need to cover the well are clearly not understood by the villagers. It is a significant oversight of the Jalswarajya project that these issues are not clearly explained to communities constructing drinking water projects, particularly considering that once the project is completed, it will be the community's responsibility to maintain it.

When looking at Samundi's multiple water-use requirements, the need for better linkages with other parts of society become apparent. The national cooperative bank in Trimbakeshwar will not lend to women's groups, causing difficulty for the WEC in receiving a loan for their enterprise activities. Mahila Mandal needs access to a larger source of credit than their small revolving loan fund if they are to initiate the types of activities that Jalswarajya is suggesting. If Jalswarajya is promoting the establishment of enterprises by women, then they should help make linkages with credit as part of that initiative. The statewide lending situation must expand to incorporate women. Similarly, 14 km is a long way for women from this community to take produce to market without some form of transportation. Even on the bus it will be difficult for them to haul their vegetables to market, and the bus only runs sporadically. Establishment of a marketing committee for the women to combine their produce for sale and coordinate transport to market would help them in this endeavor.

Yet despite the myriad challenges Samundi (and particularly the women in the community) faced a few years ago, they have shown incredible spirit and energy in working together to improve their situation. From alcohol prohibition to kitchen gardens, they have revealed that even communities with few financial resources and little social capital have the ability to improve their situation and take responsibility for water resource management. They understand the need for equitable distribution through household connections to ameliorate past water conflict at the public taps. They are also a good example of a community working within the constraints of the Jalswarajya Project to use wastewater and the current excess in the drinking water system for productive use. Time will tell whether or not this productive use will continue past 2020, when all of the domestic water is meant to be allocated. If the enthusiasm of the community continues, they will utilize other opportunities well before then to achieve their water resource needs.

CHAPTER 12

# COMMUNITY-LEVEL LESSONS

Photograph by Ratnakar Pawar.

The situation for MUS in Maharashtra most likely reflects the reality of future MUS upscaling: attempting to use a state drinking water project as a vehicle for integrating multiple uses at the village level. As such, these two cases instruct the implementation of MUS globally. While it is much more difficult to work within the confines of a preestablished state drinking water project than being the direct implementing organization of MUS-by-design projects from the onset, it is still possible to achieve multiple uses of the system given creativity and a motivated community. The most effective way to incorporate MUS into a statewide project is to be part of overall program planning from the onset. But unless productive water use is truly encapsulated in design, incorporation of MUS must be done on a village-by-village basis. And if contact has to be made at the community level, upscaling will be a slow and painstaking effort and have varying results from community to community. Just looking at the differences between the achievements of Kikwari and Samundi, despite the fact that they are both motivated "model" communities, shows this variation. However, the net effect of adding MUS information and options to what the leadership of a community is already doing with their water resources is of significant benefit.

The organization of this chapter, like chapter 6, is based on the 14 principles outlined in the CP-MUS Project Action Research Framework. (See Van Koppen et al. 2006 for more information on the MUS principles.) Information from partner MUS work, other than the Kikwari and Samundi cases, is used here to enhance the lessons from those cases.

## LIVELIHOODS-BASED SERVICES

As identified in the Project Implementation Plan for Jalswarajya, the overall aim of the project was not simply to complete water supply schemes, but to "build the capacity of the communities to be able to link different water supply projects from various sources." By looking at the cases in Maharashtra, this project is simply lining up with what communities have already been attempting on their own.

### COMMUNITY INGENUITY

Integrating multiple uses of water resources is something that Maharashtra residents have to do to maximize use of the very scarce resources they have. Kikwari and Samundi cases show that given the right resources, some motivated communities will creatively meet their water resource needs. The Kikwari case illustrates how a village community, with initiative from a dynamic community leader, has taken water resource management into their own hands and shown a great deal of creativity in project design and implementation throughout the past few decades. They used four successive projects over the past twenty years to: (1) gain village access to groundwater for domestic use through a "drinking water project (1982)"; (2) augment groundwater capture by constructing runoff barriers through the "Soil and Water Conservation Program (2003–2005)"; (3) capture greywater and recycle it for productive use through the "Village Sanitation Campaign (2003–2005)"; (4) further augment the water supply through the "Jalswarajya project (2005–2009)" to which MUS is attached. In working with the Kikwari villagers, it is clear that they have been mixing and blending the outputs of all these "projects" to best meet their multiple needs. The thinking and planning by the village is solidly focused on integrating all water sources and matching them to their needs in a water-scarce environment. The MUS input to Jalswarajya brings some new technology tools plus strong support from the community and field-level implementing NGOs for the MUS concept and approach.

The Kikwari case supports the argument for water resource development planners to listen more carefully to the village voices and adjust inputs to support them. A few examples of community-level initiatives were: greywater collected via village drains (no connections to toilets) became common property, and reuse was directed to school ornamental plants and a 1.5-acre horticulture plot cultivated by GP staff to increase their income; all direct household connections were retrofitted to limit flow by reducing pipe diameter to achieve better equality in the public-tap distribution system; water harvesting, gully plugs, and other conservation measures were integrated with water abstraction and distribution activities.

*"The people don't separate and make distinction for uses, but the government departments do."*
—CEO of GRASP

SEVA, IDE's partner organization in Ahmadnagar, worked with a community called Baloni that was so interested in multiple uses of their water that they lobbied their district Aple Pani (as mentioned previously, Aple Pani, not Jalswarajya, is operating in Ahmadnagar District) officials to allow water for 10–15 various industries in their village including manufacturing of mattresses, fishing nets, fiber products, chemical products, and plastics. They wanted the revenue source that would be generated from the higher tax rates that the industries paid.

## CONSIDERATION OF FUTURE NEEDS

Kikwari was also able to translate their future needs into their system design. In Jalswarajya the drinking water schemes are designed to supply enough domestic water for the projected population in 2020. While Samundi will be using the current excess in addition to greywater for irrigation of kitchen gardens, Kikwari has ensured that the future domestic supply is not threatened by allotting the previous drinking water system for productive use. Samundi unfortunately did not have this option because their previous drinking water system was merely two hand pumps and a well that they dug themselves. This same well is the source of their new Jalswarajya system.

## COST AND ACCESS

Tribal access to water is a critical issue in Maharashtra. As a disadvantaged group, cost considerations are important for any new technology. Even the landless farmer interviewed in Samundi stated that the "family-nutrition" drip irrigation kits for kitchen gardens are affordable to the poorest in the village. And the wealthier landowners will allow the landless access to small plots of land for use of the "family-nutrition" drip irrigation kits. Kikwari has also displayed a desire to understand the needs of the most disadvantaged of their community. They not only established a 1,000-liter storage tank for the tribal cluster, but also helped in establishing a goat farm and compost enterprise. This enterprise allows the tribal cluster to productively use water for financial benefit through providing a service to the whole community.

## SO AND TRAINING ORGANIZATION POWER

Despite the initiative of communities to integrate their water resource needs through multiple projects, many rural villages still need a great deal of assistance in these efforts. The Jalswarajya project was meant to encourage communities to lead their own projects, but many communities do not have the capacity to manage funds, hire contractors, etc. Unfortunately, the necessary assistance is not always being provided as it should.

The training organization and SO have a great deal of power to encourage a community toward a particular idea. For example, the chairwoman of the Women Empowerment Committee in Samundi was very keen to start a dairy in the village despite the high initial costs. This was largely due to the encouragement of the local training NGO, Josepha. Josepha had trained the committee on establishing a dairy. However, Josepha failed to help Samundi secure a loan for this enterprise. Therefore, Samundi spent most of the resources they received from Jalswarajya to hire Josepha to train them on beginning an enterprise and then were unable to actually establish one. Ultimately, this was a waste of Jalswarajya funds and the time of the WEC. Adhar (the SO) was meant to follow-up with Josepha but did not, largely due to the small payment Adhar received for assisting Samundi in their work. Adhar was only paid INR 70 (US$1.72) per person for the entire project period, totaling INR 53,130 ($1,302) for regular field visits and countless hours of assistance. And the project has extended well beyond the projected 18-month period, now passing two years. With this small set rate of payment and extended period of employment, there is little incentive for Adhar to follow-up with the community or visit them often. For a community like Kikwari with a strong village leader and a good deal of resources, this is less of an issue. However, for a village like Samundi with a higher number of illiterate villagers and few resources, the importance of the SO cannot be overstated. As the liaison for the community, the SO needs greater incentive to excel at its function. Otherwise, time and money are wasted, and the community is left to pick up the pieces on their own, potentially unable to achieve stated Project goals.

## SUSTAINABLE WATER USE

Both Kikwari and Samundi cases show a concern for sustainability. This is partially contributed to by the fact that villages participating in the Soil and Water Conservation Program were given priority for receiving a Jalswarajya project. However, of more importance is the deep understanding of the problems created by water scarcity. Both villages are aware that if they do not care for their water resources, their situation of scarcity will continue to worsen. As part of the Soil and Water Conservation Program, both communities worked hard to recharge their groundwater and planted trees to reverse the negative effects of deforestation. Samundi even established an enforcement mechanism by fining violators of community conservation and sanitation rules.

Perhaps the greatest accomplishment of Kikwari was to garner participation from all community members for water conservation and management instead of pursuing individual action. They prohibited individuals from drilling borewells that would draw large amounts of water from the deep aquifer. Instead, they worked as a unit to recharge their shallow aquifer and improve their community drinking water system.

### WASTEWATER RECYCLING

Villagers in Kikwari also established a wastewater recycling system by piping the drainage water to a settling tank, which is then stored in a second tank after filtration. This water is used to irrigate a community garden and school ornamental garden. While Samundi has not yet established this system, they are planning to use their greywater as part of the water required for irrigation of their kitchen gardens. The use of drip irrigation for their kitchen gardens and the school vegetable garden will allow for efficient use of productive water and not overutilize the domestic water for productive activities.

### SUFFICIENT DOMESTIC WATER

However, as the population of Samundi grows, the current excess will be needed for domestic purposes. Samundi will have a choice: find another source for productive-use water, or expand the current domestic system for greater overall supply. Alternatively, they could borrow an idea from the Nepal double-tank system and have only overflow from the domestic tank be used for productive purposes. This could be built cheaply on their own with village contributions. They could use the remaining money from their Sanitation Campaign awards. Or they could lobby the government for assistance. As the community indicated during interviews, it is sometimes easier to obtain projects in their village because they are a tribal community.

### SHIFT OF CROP PATTERN

In Kikwari, Mr. Kakulate encouraged villagers to irrigate horticulture with drip systems instead of cultivating sugarcane. Now there are 60–70 farmers who have 1–2 acres of fruit trees irrigated with drip. Unfortunately, one women's SHG is cultivating 12 acres of sugarcane with flood irrigation on community land. Although they have not pledged a shift to less-water-intensive cropping, they are convinced that using drip instead of flood irrigation will be a better

> *"Once you do water budgeting with the village community, people are able to better plan for their crops; they know how much they will receive in certain seasons and what crops are best to grow."*—CEO of GRASP

way to conserve water and are currently working to implement this plan. These efforts are definitely a positive step, but larger statewide incentives to grow sugarcane must be adjusted to encourage cultivation of crops requiring less water. Officials at the state level are beginning to encourage water budgeting and watershed development work, predominantly recharging wells, but they have yet to actively adjust the economic factors encouraging growth of sugarcane in the state. Until these systemwide factors are addressed, the incentives to grow the water-thirsty crop will outweigh the lure of prize money for conservation efforts.

### MITIGATING CONFLICT

In both cases, the communities worked to mitigate water conflicts and ensure equitable distribution. In Samundi, the community decided that for the time being individuals could only fill two containers of water from the hand pump at one time so that all households had an equal share and conflicts at the pump would diminish. Now that they are building the Jalswarajya scheme, they are planning to install household connections to reduce wastage and ensure equal access for all households.

In Kikwari, households that had direct household connections from the previous drinking water system were found to be using far more than other households. Therefore, in spite of protest from these influential households, the user group collectively chose to limit their supply by narrowing the diameter of the pipes to their homes. This protected the domestic needs of all community members. With the new scheme, all households will have direct connections for both domestic and productive use from the separate tanks and distribution lines.

### NEED FOR IMPROVED WATER QUALITY

Unfortunately, Samundi showed less of an awareness about water quality issues than Kikwari, indicating a lack of knowledge transfer from Adhar. While Kikwari is planning to cover all of its wells, Samundi's well is open, and its animals are allowed to access the well. Samundi also has no current plan for covering the well or treating the drinking water. This indicates a lack of understanding of the importance of protecting the water source and reducing waterborne illness. There are two possible explanations for the discrepancy between the two cases on this issue. The education level in Samundi is much lower than in Kikwari, so Samundi probably started the projects with less knowledge of these issues. However, the issue of water safety is one that the SOs are supposed to cover in the Jalswarajya Project. Either Adhar did not thoroughly educate Samundi on the issue, or the community did not deem it important. Considering how thoroughly they soaked up the dairy promotion information from Josepha, it is more likely the former than the latter. Jalswarajya should work to ensure that SOs adequately educate communities about the health issues associated with drinking water schemes.

## APPROPRIATE TECHNOLOGY SELECTION

Unfortunately, through Jalswarajya there was very little flexibility for communities to adjust the technology for the scheme. The Technical Service Provider chose the design from a limited list approved by the Jalswarajya Project. And IDE did not approach Jalswarajya early enough in their planning process to have a chance to explicitly plan productive use into the systems. It is recognized that planning productive use into the system would have allowed communities to more explicitly use the water for productive purposes and would have ensured both domestic and productive uses could continue well into the future. Since this was not accomplished, the next best approach was to use the excess currently in the system (for the projected population of 2020) for productive purposes now. Partially of their own accord and partially from MUS input by IDE, communities worked around the Jalswarajya limitations to ensure that the technologies used worked for them.

## INNOVATIVE USE OF TECHNOLOGY

Kikwari used multiple techniques to recharge ground water, including check dams, trenches, and a rainwater harvesting structure on the school, with water filtered and used to recharge the groundwater feeding the hand pump near the school. They also incorporated solar street lamps to circumvent irregular delivery of energy in the region. They created wastewater filtration and decided to use the old drinking water system for productive uses to save the new scheme for domestic purposes. In Samundi, instead of incurring the additional cost of larger pipelines, the community decided to put more effort into management and distribution to ensure that sufficient water for both domestic and productive use was distributed to each house.

## ENSURING EQUAL DISTRIBUTION

Rules of distribution vary depending on system uses. In MUS projects where the technology links domestic and productive distribution systems, the "equal share" concept from domestic-only systems supersedes other distribution rules commonly seen in irrigation-only systems (e.g. distribution based on size of landholdings or proportion of financial input per household to the project). Since these systems are used for domestic purpose as well as productive purpose, communities have sought ways to ensure equitable access. The Kikwari case illustrates design that limits the delivery volume to those with household connections so they could not use more than those without household connections. To accomplish this, the previously buried connection was brought aboveground to be visible to others. They also creatively borrowed an idea from drip irrigation design to limit flow: before entering the house, water flow was restricted by the insertion of a short section of small-diameter tubing, such as used for drip irrigation. They also realized the need for the tribal community to have additional storage, building a 1,000-liter tank for tribal water storage.

One consideration in using the current excess water in the system, is how the use of this water will change over time. In all rural communities, the added capacity for population growth is generally utilized for other purposes at the beginning, and as population grows, the community finds ways to adjust to less water availability. With the VWSC managing the system, there is a formal structure in place to ensure that as population increases, domestic needs are not overlooked, particularly for marginalized populations. An interesting way that villages in Maharashtra (including Kikwari and Samundi) attempt to establish transparency in water allocation is by writing the water-balance and scheme-budget information on the wall of a building in the community. This technique could be taken one step further to show the design excess and list each application and how long that application is allotted the set amount. This would allow the community to come to an agreement about how the water will be used over time and ensure that domestic needs are met in the future.

### LOWER HEALTH RISKS

Another important factor in design, particularly of domestic systems, is health. Kikwari has placed an emphasis on identifying water-related health risks and coming up with solutions like covering the wastewater canals, covering the community wells, and treating well water with chlorine. They also moved compost piles from beside the homes out to individual's farms and the goat farm.

Through dealing effectively with wastewater—using covered canals to transport it outside the village for filtration and use on a 1.5-acre community horticulture farm—Kikwari has decreased breeding grounds for mosquitoes in their area. The benefits of this were seen when an area outbreak of Chikungunya, a relatively rare form of viral fever caused by an alphavirus that is spread by mosquito bites, passed the village altogether.

As part of the Sanitation Campaign, Samundi built latrines and designed gravel soak pits at each household for their wastewater. These soak pits cut down on mosquito breeding by removing pools of stagnant wastewater near each home. Unfortunately, Samundi did not carry forward these efforts to reduce health risks into the Jalswarajya Project. They are not covering their wells or planning to treat their water. As mentioned above, Jalswarajya needs to be more consistent on this issue.

## INCLUSIVE INSTITUTIONS

As part of the Jalswarajya Project both Kikwari and Samundi were required to establish three committees for effective planning, construction, and operation of the system as well as development of income-generating enterprises for women. In fact, both communities had shown previous initiative in working together toward their water-management goals. In Kikwari, it was mostly the men who led the effort, instigated by the vivacious leader farmer Mr. Kakulate. In Samundi, it was the women who instigated change in their community. In both villages the existing group structure morphed into one of the

> *"If by virtue of community planning availability for domestic and productive water can be improved, it will help women. Therefore, it is imperative to involve the women in the planning."*—CEO of GRASP

Jalswarajya committees, but leaders basically retained their previous influence in the village. In Kikwari, the men who were leading the efforts became the VWSC. In Samundi, the group Mahila Mandal became the WEC.

Both communities encouraged women and tribal households to participate and actively worked toward empowering them to form their own enterprises. In Kikwari, the tribal households established the goat farm and compost-making activity. One of the women's SHGs (80 percent tribal) also leased community land for production and sale of wheat and sugarcane. And the community allowed the GP staff (public servants who receive low levels of income) to use a community plot for cultivation and sale of horticulture crops. Now that the scheme is completed, all households will have access to productive-use water for cultivating kitchen gardens. And wealthier landholders in the community have agreed to allow landless farmers to cultivate kitchen gardens on their land. This will probably have the largest impact on tribal households in Kikwari that currently have a lower level of income and little access to land.

Likewise in Samundi, all will have access to water for kitchen gardens. Women in the community are beginning to establish kitchen gardens with drip irrigation. They recognize that consumption and sale of these vegetables will most likely reduce their food costs and increase their income.

## ADEQUATE FINANCING

Jalswarajya has a set payment contribution for all its projects. Tribal communities pay 5 percent of the total scheme costs. They choose the breakdown of this 5 percent into labor and cash contribution. Samundi's breakdown was 1 percent cash and 4 percent labor. Nontribal communities pay 10 percent of costs in labor and cash. Kikwari also chose to use their substantial cash prizes from the Soil and Water Conservation Program and Sanitation Campaign for continued village development activities. In addition, they received a subsidy for installing the solar lamps. Some Samundi households received a subsidy for toilet installation. All those who decide to purchase family-nutrition drip irrigation kits will be required to pay the full cost of the kits. However, households who purchase them will be able to recoup the cost of the kits from vegetable sales.

CHAPTER **13**

# APPLYING THE LEARNING ALLIANCE APPROACH

Photograph by Monique Mikhail.

The Learning Alliance experience in Maharashtra contains important lessons for the potential upscaling of the MUS concept in the state. By attempting implementation of MUS projects through a larger state-led drinking water scheme, the experience in India has illuminated hurdles and limitations in expanding the MUS concept through a state-government program. MUS work in India took place only in the state of Maharashtra. Therefore, the state-level government represents the "national" level for the MUS Learning Alliance in India.

Information in this chapter is compiled from interviews conducted in April 2007 with the following:

- IDE staff in India
- Several community members involved in their Village Water and Sanitation Committee
- Two community members involved in their Women Empowerment Committee
- Representatives of local-level NGOs (those who are acting as Support Organizations in the state drinking water projects)
- Intermediate level NGOs working at the district level in each of the three target districts
- The Block Development Officer, Satana Block within Nasik District (Kikwari is in Satana Block)
- The Nasik District Monitoring and Evaluation Specialist for Jalswarajya
- The State Aquifer Pilot Coordinator of the Jalswarajya/Aple Pani project within the state-level Water Supply and Sanitation Department
- The State Coordinator for the Water and Sanitation Program of the World Bank

## THE LEARNING ALLIANCE PROCESS

### SELECTING PARTNERS

In Maharashtra it is historically the government that is responsible for both irrigation and drinking water supply schemes. The irrigation systems are predominantly large-scale irrigation canals and dams, while drinking water systems are high-cost schemes built by contractors and handed over to the Gram Panchayat. NGOs have generally not been involved in scheme design or implementation until these recent state projects. However, NGOs have been involved in watershed work for the past few decades, focusing on water budgeting, water source strengthening, and conservation education as the groundwater supply in the state diminishes and wells run dry.

With IDE's small staff in Nasik, the Learning Alliance (LA) concept was incorporated within MUS activities from the onset as a mechanism for promoting MUS. In order to select LA partners, IDE staff collected baseline information about the NGOs working in Maharashtra from two sectors—those working on watershed development and those working as SOs for Jalswarajya and Aple Pani. They obtained information from existing NGO and government acquaintances to profile the various NGOs in the state, and particularly in the three selected districts. They also acquired information on the projects the government (Department of Agriculture, Department of Irrigation, and Department of Water Supply and Sanitation) was working on. IDE staff held meetings and phone conversations with representatives in 40 organizations within the three districts, giving them an overview of the MUS concept, exploring possibilities for collaboration, and inviting them to a state-level LA workshop being planned in Nasik. In these first meetings, it was determined that some of the chosen organizations were no longer working in water resources, so they excused themselves from the LA.

IDE staff also met with district-government employees to gauge government activities at the district level and see the compatibility of MUS work. Included in those meetings were the Executive Engineer from the Department of Irrigation, the Executive Engineer from the Department of Drinking Water Supply and Sanitation, the Jalswarajya Project Coordinator, the Deputy Chief Executive Officer of the Zilla Parishad, and the District Agriculture Officer.

The major kickoff for the LA in Maharashtra was the Introductory LA Workshop held in Nasik on March 18, 2005 (see Figure 13.1). In addition to the district-level NGOs and government officials, some partner NGOs in other states of India also attended. About 20 of the invited organizations attended. At the workshop, the MUS concept was introduced and its relevance to Maharashtra discussed. The discussion centered on the concept of the LA, its relevance for the water sector and MUS, and how it should function in Maharashtra.

## BUILDING RELATIONSHIPS

### State Level

After the Nasik workshop, IDE staff met with the director of the Jalswarajya/Aple Pani Project (who was also the director of the Groundwater Survey and Development Agency at the time) and the state coordinator for the Water and Sanitation Program of the World Bank to determine how MUS could be incorporated into their projects in the three chosen districts. This was the first meeting of the state-level officials of the two Projects. Unfortunately, the planning phase had already been completed and rules of operation established. And since the goal of the project was community capacity building, state-level

**Figure 13.1 Participants discuss MUS in breakout groups during the Introductory LA Workshop in Nasik**

Photograph by Sudarshan Suryawanshi.

officials directed IDE to approach communities with the MUS idea and attempt to incorporate it into the schemes.

## District Level

With this information from the state level, it was determined that the best course of action would be direct interaction with the SOs in each of the three districts. Thus, the development of the relationships IDE had begun to establish through initial contacts and meetings and the Nasik workshop became critical. The strategy was to have district-level LA workshops to build relationships and establish a functioning NGO network at the district and local levels. At these workshops, a lead organization would be identified for each of the three districts. These organizations would take responsibility for guiding the district-level LA. The other NGOs in the three districts that were acting as SOs for Jalswarajya/Aple Pani would then work with communities to incorporate MUS into their schemes.

This second round of district-level meetings included roughly 30 NGOs in the three districts along with a few government representatives, educational institutions, and other stakeholders in the Jalswarajya/Aple Pani projects (such as Technical Support Providers). NGOs were invited to the workshop in their districts. If the NGOs could not attend the workshop, bilateral meetings were held between IDE and the NGO staff. The organizations who were present at each of the workshops are listed in Table 13.1.

**Table 13.1: District-level Learning Alliance workshops**

| District | Organization/ Representative Name | Organization/ Representative Type | Directly Involved in Jalswarajya/ Aple Pani |
|---|---|---|---|
| Nasik | Vachan | Local watershed NGO | no |
| | Adhar | Support Organization | yes |
| | BSS | Support Organization | yes |
| | Samaj Pariwartan Kendre | Local watershed NGO | no |
| | Sahyog | Support Organization | yes |
| | Navnirman | Support Organization | yes |
| | Tehsil Agriculture Officer | Government | no |
| | Jalswarajya Technical Support Group consultants | Jalswarajya consultant | yes |
| Ahmednagar | SEVA | Support Organization | yes |
| | GARD | Local watershed NGO | no |
| | NISS | Support Organization | yes |

| District | Organization/ Representative Name | Organization/ Representative Type | Directly Involved in Jalswarajya/ Aple Pani |
|---|---|---|---|
| | Bosco Gramin Vikas Kendra | Local watershed NGO | no |
| | WOTR | Local watershed NGO | no |
| **Ahmednagar (cont.)** | Aikya Seva Kendra | Support Organization | yes |
| | Director of College Institute of Social Studies | Educational institution | no |
| | GRASP | Local watershed NGO | no |
| | Janarth | Support Organization | yes |
| | MSSM | Local watershed NGO | no |
| **Aurangabad** | Mano Rural Development and Research Institute | Local watershed NGO | no |
| | Jankidevi Bajaj Gramvikas Sanstha | Support Organization | yes |
| | Jeevan Vikas Sanstha | Support Organization | yes |
| | Agriculture Technology Management Agency[1] | Government Agency | no |

***Nasik District*** In addition to the organizations listed in Table 13.1, staff from the Jalswarajya project were invited to the first Nasik district-level workshop in June, 2005 but did not attend. An introduction of MUS was given in the workshop to reiterate what had been discussed in the state-level Nasik workshop. IDE staff realized at this first district-level workshop that the message about MUS had not fully reached all of the participants at the state-level workshop. Many of the attendees were confused about the MUS concept and how it could actually be implemented. It was decided that collection of information about de facto MUS systems in the district would help the local NGOs crystallize their conceptualization of MUS. The NGOs BSS, Adhar, and Navnirman showed the greatest interest at the workshop. They agreed to encourage the communities they worked with (about 12–15 villages total) to add a kitchen-garden component to their projects. They would recommend the use of excess drinking water along with IDE's "family nutrition" drip irrigation kits (See Appendix 5) for application. The family nutrition kit was demonstrated at the workshop, and IDE agreed to give a more formal training to the NGOs and communities jointly. Since IDE was based in Nasik, it would assume the leadership NGO role for the LA in this district. Kikwari and Samundi villages were chosen to become pilot MUS projects in Nasik District. A follow-up workshop was held in the district in November, 2005.

***Ahmednagar District*** The first Ahmednagar District workshop, held in March, 2005, was organized with the help of SEVA, who was emerging as a strong district leader. The meeting was similar to the one in Nasik with a reiteration of the MUS concept, discussion of MUS activities in the district, and demonstration of the family-nutrition kit. The four NGOs that displayed the most interest in Ahmednagar District were SEVA, GARD, NISS, and WOTR. They agreed to promote the installation of kitchen gardens with the family-nutrition kits in about 20 villages amongst them. Despite the fact that GARD and WOTR were not directly working with Aple Pani, they decided to remain involved in the LA. SEVA decided to take on the leadership role for the LA in Ahmednagar with technical support from IDE. A follow-up workshop was held in the district in September, 2005.

***Aurangabad District*** In Aurangabad, IDE relied on the assistance of a water-conservation consultant to organize the one workshop in the district held in March 2005. He initially showed interest in MUS, but upon realization that there was no employment opportunity, he withdrew. The program for this workshop was the same as the other two districts', although the meeting proved less fruitful. None of the NGOs present were interested in leading the LA for the district. This was largely due to the choice of organizations that the consultant had selected to invite to the workshop. He had failed to invite Dilasa, the Capacity Building Consortium (CBC) organization for Aple Pani in Aurangabad District. Six months later, Dilasa was working with IDE on another project and came to learn about MUS. They were very interested in the project because of their role in Aple Pani and also due to their extensive watershed development work. Six months after the Aurangabad LA meeting, Dilasa became the lead organization for Aurangabad District.

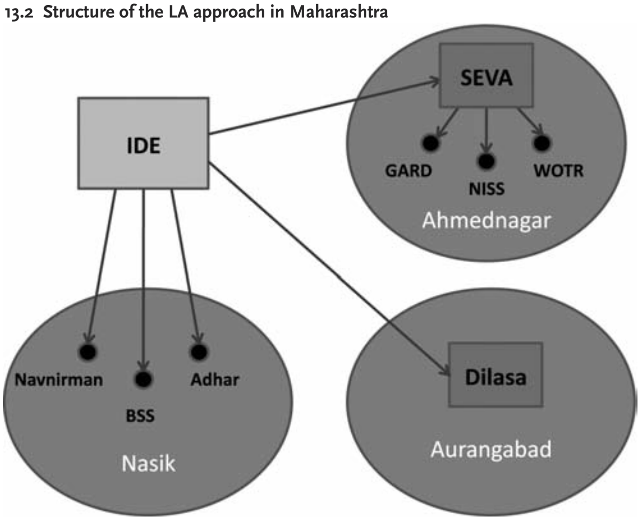
## Community Level

Once coordination with the NGOs in the district was established, the focus turned to the local level. Meetings were held with local-level stakeholders—the Village Development Officer, the GP, the three community committees established through Jalswarajya/Aple Pani, and the local Support Organization. Meetings were held in four villages in Ahmednagar, four villages in Nasik, and one in Aurangabad. The purpose of these visits was to assess the planned activities of Jalswarajya/Aple Pani, introduce the MUS concept, and discuss the practicality of kitchen gardens. All villages approached were pleased by the idea and said they would establish the kitchen gardens and use extra water from the water scheme to irrigate once the scheme was completed. After these initial community meetings, IDE focused on building relationships with the stakeholders in the two model villages of Kikwari and Samundi for Nasik District. Partners in the other two districts were simultaneously taking on this task in their own districts. The structure of the LA efforts in the three districts can be seen in Figure 13.2.

### SHIFT FROM "ADVOCACY" TO "FACILITATOR" MODE

Because of IDE's small reach in Maharashtra, the advocacy role was necessary to spread the idea of MUS, while building the capacity of local partners was essential in reaching more villages for implementation. The lead organization

**Figure 13.2 Structure of the LA approach in Maharashtra**




Courtesy of Monique Mikhail.

for each district was meant to shift quickly from the advocacy role to the facilitator role in order to have further reach and quicker scaleup. However, the advocacy mode took longer than anticipated in Maharashtra because of the inability of partners to truly grasp the concept of MUS. Several meetings were held with both individuals and groups, but in each of the meetings the concept had to be recapped. IDE is just now entering the facilitator mode, particularly with Dilasa, SEVA, and the Water and Sanitation Program within the World Bank. And advocacy of the concept still continues.

## BUY-IN AT THE VARIOUS LEVELS

Although some level of buy-in at the state level was required for MUS implementation through Jalswarajya/Aple Pani, state officials did not fully support MUS. This was due to lack of flexibility in the already-established Jalswarajya/Aple Pani process. To be truthful to the project's community-led approach, state-level officials rightly directed IDE to the communities to manage MUS implementation. However, this response was also a way for the officials to brush off the larger implications of planning for multiple uses of water at the state level and a lack of desire or ability to adjust the prevailing paradigm.

At the local level it was apparent that communities were interested in multiple water uses, and some had already been creating their own de facto MUS systems with the previous schemes they had available to them. The concept of MUS was not difficult for them to grasp, although the actual implementation was more difficult due to the confines of the Jalswarajya/Aple Pani project. SEVA worked with one village that was so interested in multiple uses of the water that they pressured their district Aple Pani officials to allow water for various industries in their village and then collected tax from these industries for the water use.

District-level buy-in varied per district and per stakeholder. The Jalswarajya/Aple Pani officials at the district level were less interested in MUS and were happy to leave the actual details of implementation up to the CBC, SO, and community. However, as evidenced by the community that worked to have an industrial-water requirement included in their system design, it was difficult to get support from the district Jalswarajya/Aple Pani officials for actual MUS-by-design. District-level officials claimed that they were limited in the ability to support MUS because they needed a directive from the state level. And, while the state was allowing MUS implementation, they were not actively promoting it or changing policy to fully encourage it. The district bureaucrats were also much more comfortable recommending that communities use wastewater for kitchen gardens rather than water directly from the system.

Communities could, however, choose to use the water they received as they wished. The CBC and local SO partners were largely responsible for implementation of the project, training, and the additional development work with WECs. Due to discord between the Nasik CBC and the district Jalswarajya/

Aple Pani officials, the CBC dropped out of the project, leaving a hole in guidance of the local SOs and communities in Nasik District. Therefore, the strongest communities and SOs were the most successful. Since Dilasa was the CBC in Aurangabad and SEVA is the CBC for Ahmednagar, their partnerships with IDE and their buy-in of the MUS concept was critical to MUS implementation in these two districts.

Initially, local NGOs in Nasik were immediately willing to implement MUS, whereas in Ahmednagar, organizations were less receptive. Nasik has relatively more water than Ahmednagar, and much agriculture in Ahmednagar is predominantly rain-fed. Thus, the priority of NGOs in Ahmednagar is solely to provide drinking water. Ultimately, NGOs in Ahmednagar became more receptive to the idea of MUS. And, on the whole, district-level NGOs were very interested in the MUS concept and encouraging implementation, while the district-level government was less supportive.

## PARTNER CONCEPTUALIZATIONS

### UNDERSTANDING OF MUS

Although it took multiple meetings to truly convey the meaning behind MUS, local NGO partners and community members more readily accepted the concept. One partner stated “MUS is not just a water supply scheme. It involves livelihoods for people.” Another partner mentioned that villagers do not make distinctions between the uses of water, whereas government departments do because their funding is drawn from different sources. A third partner recognized that the user has to understand the water balance and how to use it without disturbing the natural cycle. This partner saw MUS as multiple uses of water on an individual basis: once domestic needs were met, it was up to each individual to use the available water in the most effective way. A fourth partner mentioned that after the MUS workshops they realized that storage of water was an essential component to allowing communities and individuals to better manage the use of their water resources. The key for this organization was not the design of the scheme but the judicious use of water and the creation of a plan for various uses.

### RELEVANCE OF MUS FOR MAHARASHTRA

All those interviewed agreed to the relevance of MUS for Maharashtra but elaborated upon many different rationales. First, most of the organizations mentioned the growing need for effective water-use planning due to depletion of water resources for an increasing population in the state. With recent droughts, drying wells, and widespread need for tanker-supplied water in the dry season, all stakeholders are exceedingly aware of the need for groundwater recharge, more efficient use of water resources, and, above all, more cohesive planning. There was, however, disagreement among partners as to whether the most effective avenue was individual action or community participation.

Second, while Maharashtra has policies that mandate the integration of water resource development, there has been no implementation of these policies, and they are lying dormant. One partner mentioned that MUS would be useful to reduce the dichotomy between domestic and productive water uses, allowing for the true integration of delivery at the grassroots level. The time could be ripe in Maharashtra for the acceleration of this concept because of the recent emphasis on strengthening the GP and its ability to implement projects for communities. If projects could be channeled through the GP, it would be more feasible to combine separate schemes. As such, it would be easier for villagers to work with the government agencies responsible for water resource development. Even according to the Satana Block Development Officer (BDO) in Nasik, drinking- and irrigation-water schemes should be planned together. He has peripheral involvement with Jalswarajya and Aple Pani, but there are two departments within his office that deal with water resources—Water and Sanitation and Minor Irrigation. He felt that with combined planning, the schemes would be more financially viable. The departments could be merged and only one department staff would need to be hired.

*"Day by day the quantity of water is reducing and the population is increasing; whatever available sources are there need to be planned properly for multiple uses."*
—Executive Director, GARD

Third, it was felt that integrated water resource planning for MUS would increase the transparency of government actions. Due to severe water scarcity caused by drought, overuse of groundwater, and high population growth, several contractors, bureaucrats, and legislators are becoming involved in collusion around emergency tanker schemes. When the district declares a state of water scarcity, the government is legally allowed to take possession of private wells. Some corrupt officials are allowing tanker contractors to take water from a private well in one village and sell it in another village. One partner felt that if there were integration of water resource management at the village level and communities were aware of their water budget, they would be able to assert pressure on the government to reduce this corruption.

Fourth, interviewees thought that MUS would increase the ability of farmers to undertake availability-based irrigation planning. As the community creates a water budget, farmers are allotted a certain amount of water for irrigation. Knowledge of this set amount raises the likelihood they will grow less water-intensive crops.

Lastly, one partner mentioned the relevance of MUS in relation to the gender dimension of drinking water. The enlarged availability of water for both domestic and productive uses would benefit women in many ways. Not only would they have readily available water for domestic needs (traditionally the female realm), but they would also have water available to grow kitchen gardens. This would increase the amount of vegetables available for consumption as well as generate income for the household. Recognizing the potential impact on women, it is imperative to involve them in the planning process.

## DIFFERENCE BETWEEN MUS AND OTHER WATER RESOURCE DEVELOPMENT IN MAHARASHTRA

When queried about the differences between MUS and other water resource development projects in Maharashtra, the major difference mentioned was the involvement of the community. Historically, the Maharashtra government has not included the community in its projects. And although the current trend at the state level is to give control of drinking water schemes to the community, the district-level government institutions are not fully buying-in to the community-involvement concept. Partners also felt that MUS is a more comprehensive way to plan. It takes into account all sources—private and public wells—in water budgeting and use planning. Government schemes, on the other hand, neglect to factor in the private wells.

## BARRIERS TO SCALEUP

There are many reasons that interviewees felt MUS is relevant to the state and an improvement upon the current way that water resource projects are constructed. Everyone agreed that the MUS approach should be scaled up in Maharashtra, but they felt that there were many barriers to expansion.

### Lack of Awareness

Several of those interviewed mentioned a lack of awareness of the MUS concept as the major barrier in scaling up. Many agreed that there is an understanding of MUS at the community level, but district- and state-level players (SOs and government) were lacking. Many partners voiced frustration that although state-level senior bureaucrats talk about integrated water resource management, they never actually work toward it. Several NGOs indicated that the continual transfer of government staff from one department and region to another made building relationships and spreading the MUS concept difficult because they were perpetually teaching new people within the government about MUS and attempting to get buy-in. The supply-driven approach to local problems is still dominant in Maharashtra. Bureaucrats are used to deciding what a particular type of scheme should look like and imposing those schemes on communities. Plus, the overall hydrology of the system is not studied or well understood. Water resource assessments are often based on British models and standards set prior to independence.

### Quality and Quantity of Water Required

The quality of water required for different uses is distinctive. The requirements for drinking water quality are much higher than those for irrigation, and the cost of treatment for potable water is an added investment for a community. Therefore, it is seen by many stakeholders as a waste of funding to treat water to drinking-level standards and then use it for other purposes. This is seen as a major barrier to joint domestic/productive-use schemes. Additionally, there is a lack of sufficient water for some communities for both domestic and productive purpose. And some NGOs mentioned the further stress that population growth will place on available resources. Recognizing that domestic water is a priority, future productive use will become ever more difficult to justify.

### Land Use

Farmers that have their own private wells and do not have to depend on the community schemes are less interested in small amounts of water for kitchen gardens. With Indian village houses packed much more densely than Nepali hill villages, there is sometimes a lack of space available for kitchen gardens. Furthermore, agriculture is generally considered a large-scale enterprise in Maharashtra. Therefore, even if space is available next to homes, many do not consider small-scale vegetable plots useful. One organization suggested approaching women's groups instead of farmers because women would be more receptive to the use of water from the domestic system for kitchen gardens since they are the household member most concerned about the nutritional boost a garden would provide.

### Timing of Projects

Through Jalswarajya and Aple Pani, the project-implementation phase is fixed at 18 months. However, for many reasons including the inefficiency of the government bureaucracy to give funding, lack of community capacity to swiftly implement a scheme, the timing of the rainy season, ineffectual SOs, and other factors, most communities find it impossible to complete the projects in this required time. Due to the delay of project construction, most of the schemes are just being completed. Furthermore, the kitchen gardens and family nutrition kits cannot be established until the schemes are finished. This means that MUS initiatives take a long time to come to fruition. Long time lapses between conversations with communities about MUS and actual purchase and installation of the kits are likely to decrease their application. To remedy this, more frequent contact with the communities is necessary, requiring IDE or partner NGO staff time and resources.

### Community Barriers

There are several barriers within the community as well. Many villagers do not trust NGOs because they perceive NGOs as merely funding sponges that simply pocket development money without truly benefiting communities. Villagers also find it difficult to take time from their daily work to attend meetings, especially if they do not see the value in such meetings or trust the NGOs that are organizing them.

*"The major problem [barrier to implementing MUS] is lack of awareness; when there is no awareness, there are less people adopting it. But, as awareness raises, more and more people participate."*—Executive Director, GARD

Because of typical government scheme operation in the past, communities are also used to having projects given to them by the government without being required to contribute. Due to this reality, they often are unwilling to invest in projects and lack the knowledge of effective project management. The SO is meant to build the community's capacity to run their project, but some communities involved in Jalswarajya/Aple Pani projects have had difficulty because of ineffectual SOs. For example, communities sometimes pay the contractor the full amount at the onset instead of in installments. In some situations, contractors have taken the money and disappeared without completing the project.

### Government Barriers

There are also many barriers within the government itself for scaleup of the MUS concept. The government of Maharashtra (and India on the whole) is very highly centralized. National and state-level policy often does not correspond with reality. For example, although there is a national policy for conjunctive use of surface and groundwater, there is no government program that actually implements this concept. In fact there are actions that discourage the materialization of this concept: government imposes levies on farmers who irrigate with groundwater when there is a surface-water scheme available. Even with progressive policies in place, implementation lags. One NGO mentioned that it is easy to drive policymaking if you know the right person within the government, but implementing the existing policies can be difficult. Political instability, vested interests in party sponsors, and the favoring of closer communities (i.e. spending more money on villages that are closer to where the legislators operate) are all handicaps to effective policy action.

Many interviewees also indicated that coordination between the different government agencies would be a challenge due to a highly compartmentalized approach to water scheme implementation in the state. According to the Block Development Officer, drinking water and irrigation projects will never be planned jointly at the block level. The various departments within the block office are completely separate with distinct staff, funding, and project plans. In addition, district and state-level policymakers are often unwilling to listen to suggestions of the block-level implementation staff. Since the block level is dependent on funding from the district level, there is very little flexibility to implement a new idea within the block without enabling policy and funding from the district level. Therefore, according to the BDO, state-level policy for MUS would be required to achieve substantial action. Others interviewed felt that the most important level for upscaling would be the district-level line agencies because they have the liberty to interpret the state-level plan in the local context.

Another potential government barrier is pushback from those in government who benefit from the current situation. Officials who are participants in the aforementioned tanker collusion would be resistant to any activity that ameliorates the water-scarcity problem they profit from. NGOs also voiced that both the Department of Irrigation and the Department of Agriculture had a vested interest in maintaining the status quo. The departments would avoid new projects for fear that their power base would be eroded. The Department of Irrigation currently had the biggest budget and largest influence on higher-level bureaucracy. Others perceive the Department as being unwilling to share power with other departments (i.e. Drinking Water and Sanitation Department or Groundwater Survey and Development Agency).

Ideological barriers also exist due to long-held beliefs about water resource development schemes. When questioned about MUS, the Nasik District Jalswarajya/Aple Pani official stated that use of the system for anything other than drinking would be considered "misuse." Despite an understanding of MUS and some amount of buy-in at the state level, this particular district-level official maintained old notions of appropriate water use. While this particular official was the only interviewee who voiced such an opinion, it is believed that others within the government infrastructure would believe the same.

In order for MUS to expand, sharing of outcomes is required. Yet, effective monitoring of Jalswarajya/Aple Pani projects is lagging. It was suggested that water resource schemes be brought under the purview of the Outcome Monitoring division within the Department of Planning. Development of this monitoring division is new, however, and the Department head is a low-level bureaucrat at the state level. The appointment of someone with little political clout indicates the lack of emphasis the state level places on effective monitoring.

## OVERCOMING THE BARRIERS

### MUS and Decentralization

In order to overcome the barriers to scaleup, decentralization of the process would be required. While Jalswarajya and Aple Pani are promising examples of a change in thinking within the government (at least at the state level), the shift toward community-centered projects is just beginning in Maharashtra.

Even Jalswarajya and Aple Pani have only partially transitioned. While communities are responsible for hiring the various engineers and consultants, they do not fully plan the project. Community input is important, but it takes a high level of determination to truly adjust the Jalswarajya/Aple Pani project parameters. Baloni, the village mentioned in chapter 12, was able to successfully lobby Aple Pani to allow the inclusion of local industry into their water system. But it took a great deal of organizing and effort. Most village communities do not have this ability, even with the project capacity-building component.

Many interviewees felt that in order to have sustainability in the long term, it was important to imbed MUS within the government structure itself and not just into a limited-term project like Jalswarajya/Aple Pani. However, there were several ideas as to which government body was most suited to lead the effort. Some thought that the Groundwater Surveys and Development Agency (GSDA) would be the most suitable collaborator. Because most water resource development in the state is groundwater, the GSDA would transition to the role more quickly than other government departments. Others felt that the Department of Irrigation would be the best entity to undertake MUS but would be more difficult to convince. They are currently implementing the Maharashtra Water Sector Improvement Project,[2] which is rehabilitating 219 minor and medium irrigation schemes in the state. This rehabilitation effort could provide an effective avenue to incorporate MUS. However, most thought that the district-level government had the best ability to lead MUS work. As the head of district-level development, the Panchayat Raj Department is a critical partner. It houses both the Block Development Offices and the Zilla Parishads and is responsible for local self-governance and coordination. The Zilla Parishad contains the GPs, thereby having access to the community level. The Block Development Offices hold the district-level human infrastructure, including the Minor Irrigation, Water Supply and Sanitation, and Agriculture Departments. Additionally, at the Zilla Parishad level there is a separate department for the Total Sanitation Campaign, which already encourages the use of wastewater for irrigation of kitchen gardens and has a more substantial and flexible budget than the rest of the department. On the flip side, mismanagement and a lack of professionalism abound within the Zilla Parishad.

Ultimately, interviewees conceptualized the need for partnership on MUS. NGO/government partnerships were considered critical for MUS success, particularly considering the pattern of development employed through Jalswarajya/Aple Pani and the use of NGOs for training and liaison functions. Expanding the LA to include NGOs that work on issues other than watershed development (such as health and agriculture) would be beneficial. Relationships with academic institutions should also be strengthened. Academic institutions often provide training for both government institutions and NGOs.

## Efforts for Scaleup

Education of all stakeholders about MUS was the most cited tool for scaleup. Nearly all those interviewed felt that exposure visits to demonstration projects would be the most compelling way to educate people about MUS and expand the approach. For those who are beyond the reach of exposure visits, strong documentation and publicity of the successes of pilot projects will be necessary. There are also SOs in each district that are responsible for performing Information, Education, and Communication (IEC) activities for the district-level government, communities, and other NGOs. Although some partner NGOs (mainly SEVA and Dilasa) have already incorporated the MUS concept into their IEC activities, other NGOs responsible for IEC could be educated about MUS. However, both SEVA and Dilasa agreed that bureaucrats often resist training. For example, many government agencies have training quotas. Instead of using educational institutions for training, the agency will send staff to other government agencies. This allows the agencies to exchange money within government instead of actually spending the money. To overcome this, a training of trainers was suggested, which would be conducted by the CBCs in each district. In essence this would create a team of individuals who would encourage MUS in each district, casting a wider net to generate interest. A few interviewees mentioned that policymaking at the state level would be key to upscaling. They suggested a full-fledged advocacy campaign as the most effective method. Tools mentioned for upscaling information dissemination included:

- exposure visits
- newspapers, TV, radio, a promotional video
- songs and slogans
- holding Gram Sabha meetings that include movies, posters, etc.
- training materials in Marathi for district officials
- presenting at water resource conferences and the Institute of Engineers and Indian Water Works Association conferences[3]
- posters, pamphlets, pictures, handouts for Village Development Officers

Most interviewees also mentioned funding as a critical component for scaling up. Without the finances to fund MUS projects, the effort to spread the approach would be unlikely to succeed. This was evidenced by IDE's experience with local NGOs in the three districts. Some who were initially interested in participating dropped out when they realized that IDE would not be providing them with funding for the projects. Additionally, in order to strengthen the capacity of Water Users Associations, funds need to be provided for community capacity building. The members of the Water Users Association would then be able to share the concept with other neighboring villages.

## OUTCOMES/CURRENT STATUS

### COMMUNITIES/LOCAL NGOS

Due to the extension of scheme implementation beyond the planned 18 months, the execution of the MUS component was delayed. IDE and partner organizations have received verbal agreement from villagers to purchase family nutrition kits and from some community organizations (such as schools) to grow kitchen gardens with the excess scheme water. Initial training on the family nutrition kits has been conducted, and follow-up training is occurring.

### INTERMEDIATE LEVEL

At the district level, NGOs are the most interested in moving MUS forward. They are interested in establishing pilot MUS projects for exposure visits. NGO LA partners have agreed to collaborate on these exposure visits.

#### Dilasa—Lead Organization in Aurangabad

The case of Dilasa is an interesting one and worth elaborating upon. The partnership between Dilasa and IDE went beyond MUS to include another Challenge Program on Water and Food project for lift technology development. As part of this other project, an exposure visit to Nepal was arranged for Dilasa staff. Through this exposure visit they were able to see firsthand the MUS-by-design projects developed in Nepal and their effects on the lives of the community members there. Prior to their visit to Nepal, Dilasa had been actively promoting the MUS concept. They shared the idea with SOs and TSPs they worked with through Aple Pani. Within villages they taught the women SHGs and members of the three project committees about the concept. Before their Nepal visit Dilasa had also spoken with the Executive Engineer of Aurangabad District Department of Irrigation. They have ample quantity of water in their dams, but there is no adequate distribution system because previously built canals are crumbling. Dilasa explained to them that through MUS systems there could be both an increase in water availability for agriculture and income generation as well as domestic use at the farm level.

Even though these contributions to MUS were substantial, Dilasa staff mentioned that their conceptualization of MUS was fully actualized during their visit to Nepal. They were able to see concrete examples of MUS-by-design and the impact it could make with small plots of land. Due to their experience, Dilasa feels that true propagation will only come through demonstrations. They wish to give communities options for use of the excess water (i.e. kitchen gardens, food processing, or other small enterprises, depending on space availability and the skills of community members).

Within two weeks of returning from their visit, the director of Dilasa had established funding for MUS through two separate mechanisms. He met with the District Collector[4] of the Jalna District[5] and explained at length about the MUS projects in Nepal. The District Collector agreed that if Dilasa put forward a proposal for MUS development in his district, they would receive as much funding as they required for project implementation and community capacity building. Second, the Dilasa director met with Sterlites Opticals Corporation because they had previously expressed interest in funding Dilasa for development projects. Since Dilasa is already working on capacity building with Water and Use Associations near the Sukhana Dam on the Godavari River, he encouraged the company to fund MUS projects using water from the dam.

## SEVA—Lead Organization in Ahmednagar

As the lead organization for Ahmednagar District, SEVA has discussed MUS in many contexts. They are the CBC for Aple Pani in their district and have spoken with the Aple Pani staff about inclusion of livestock requirements in system construction. They also use meetings, conferences, and workshops that they attend as mechanisms for sharing the MUS concept with other NGOs. The local watershed NGOs in Ahmednagar already participate in a Learning Alliance of their own, meeting in small groups throughout the year and holding an annual conference in one of the villages they work with. SEVA also convenes regularly with other SOs working for Aple Pani. They have discussed MUS with these organizations. They have also shared information about the MUS approach with government organizations: the Zilla Parishad, District-level office of the Department of Agriculture, and the GSDA. SEVA presented the MUS concept at a workshop in March 2007 that was arranged by the GSDA. Staff of the GSDA voiced interest in seeing MUS projects that have been implemented at the grass-roots level and have promised to give information to their superiors once they have seen these pilots. SEVA is planning to have MUS-specific workshops in the future.

## GARD

GARD is an SO for five villages under the Aple Pani Project. As such, they have shared the MUS concept with the GPs and communities of these villages. They also spoke with the BDO of the block in which they work (Parner Block) and his staff, and various Zilla Parishad departments. In addition to Aple Pani projects, GARD works with 400 women SHGs in the Ahmednagar District and has shared the MUS concept with all of these groups. GARD is also a member of the same Learning Alliance of watershed organizations that SEVA is a part of and presented on MUS at the annual workshop in March 2006 in conjunction with SEVA. Several of the NGOs in the MUS LA were present at this meeting, along with the District Agriculture Officer, participants from the host community, and 15–20 people from other villages where watershed work is occurring. The director of GARD mentioned that the communities they work with are demanding water resource development for all of their needs—productive as well as domestic—which he interprets as demand for

MUS. However, due to the way schemes have been constructed in the state historically, communities are unaware that the two uses can be planned within the design of one system.

### STATE LEVEL

IDE staff has held multiple meetings with the State Coordinator of the Water and Sanitation Program of the World Bank. Through these meetings, his understanding and interest in MUS has grown. He has expressed interest in meeting with IDE-Nepal staff who have implemented MUS projects to obtain a more thorough understanding of their experience. He has also decided to put out a call for research and documentation on pilot MUS projects in a few states of India to further develop the concept. If these pilots are successful, he will share the idea with other countries in the region.

## LESSONS LEARNED

### DIFFICULTY GRASPING THE CONCEPT

The idea of MUS seems to be a very hard concept for people to grasp without seeing an actual example. Although some organizations or individuals readily grasped the concept, for others it was intangible and confusing. At the Nasik state-level workshop, the sizeable organizations (state-level or larger district-level organizations) were more engaged and interactive and seemed to grasp the concept. Staff from smaller and more local-level NGOs, on the other hand, seemed to have more difficulty. This could be due to varying education levels of staff working in larger organizations versus smaller organizations. Yet for some, even after multiple meetings, the concept had to be reiterated and clarified. This indicates that the idea is difficult to elucidate.

Also telling is the fact that all interviewees stated that the best way to advance MUS would be to arrange exposure visits to pilot projects. This belief was proven by Dilasa's visit to Nepal and subsequent enthusiasm for the concept and follow-through on garnering funding to build pilot projects. When comparing the propagation of the MUS concept in India versus Nepal, it becomes clear that seeing MUS in action is much more compelling than simply explaining the concept. In India, they initiated the MUS process with meetings and a state-level workshop. In Nepal, they began with building projects and then developed the Learning Alliance around sourcing of funds for those projects.

There is a catch in propagating the concept through projects, however, because people tend to envision only one model for the concept instead of seeing it as a larger platform with multiple manifestations. In Maharashtra, there was a tendency to view MUS as simply microirrigation or kitchen gardens because that is the current mechanism for MUS promotion. Similarly in Nepal, the conceptualization of MUS is based on the form that MUS projects have taken in the past few years.

Another important lesson from the experience in Maharashtra is the power of using the term "MUS" itself. Although the name chosen could vary, having set terminology for the concept is a useful tool for proliferation of the idea. In India they used "MUS" to some extent, but mostly in terms of integrating water resource use. Often the MUS concept was discussed more broadly without coining the terminology for it. This was a hindrance to spreading the idea. Having one name helps those involved to have a common understanding of the concept and gives individuals new to the idea a framework to hang their understanding on. However, as evidenced by the Nepal LA (chapter 7), even when using a common term, multiple meanings exist. Practitioners engaging in MUS should be careful to ensure that when they share the idea, they clarify what they mean by "MUS." All should seek to continually reflect upon their understanding of the ways MUS takes shape. As an expanding concept, all possibilities for MUS have not yet been explored.

## LIMITATIONS OF IMPLEMENTING MUS THROUGH JALSWARAJYA/APLE PANI

Despite the possibilities for MUS, attempting to work through the state-level drinking water programs proved a difficult route. State-level officials within the Jalswarajya/Aple Pani projects were amenable to incorporating MUS into the projects but claimed that it was the choice of communities whether or not to incorporate it. However, through the various interviews, it became clear that in order to have MUS applied through state-level projects like Jalswarajya/Aple Pani, a directive is required from the top. The projects are incredibly structured, from the selection of the NGOs, consultants, and contractors to the allocation of project funds. Therefore, even though the community could in essence "choose" MUS, it was not a real choice. The amount of water allocated by design is fixed at the 40 liters/capita/day required for the projected domestic use in the year 2021, and financial provision for the projects is planned accordingly. Although there is currently excess water for productive use, the productive-use component was not actually included in the design of the systems of the Jalswarajya/Aple Pani projects.

The restrictions on this "choice" were also evident in an observation of one IDE staff member. During the interviews, individuals (particularly those from local SOs) were afraid to say that communities were actually using drinking water for kitchen gardens and emphasized that households were mostly using wastewater. This echoes the comment of the Jalswarajya district-level official who stated that use of water for anything other than drinking was "misuse" of the scheme. While this sentiment was not repeated by her superiors, it spoke to residual sectoral views of water resource development schemes and the potential mixed messages communities are receiving about the appropriate use of water.

In order to have MUS-by-design in Jalswarajya/Aple Pani, the MUS concept needed to be presented at the onset of project design. Unfortunately, project design was completed during 2000–2002, prior to MUS. Yet even if MUS had been presented during this period, it is unclear whether it would have been planned into the project structure. There are significant barriers to integrated water resource planning in Maharashtra. And although officials are beginning to move in the right direction with water budgeting, watershed-development work (mostly groundwater recharge of wells), and increased use of water-saving technologies like microirrigation, there is still no funding support for schemes that include productive use other than traditional large-scale irrigation schemes. Even trying to explain the concept to a state-level Jalswarajya/Aple Pani coordinator in the Water Supply and Sanitation Department proved difficult. He had trouble even recognizing the government neglect of productive uses of water. All of the other puzzle pieces are there—water budgeting, groundwater recharge, encouragement of wastewater reuse, and schemes for adequate domestic water. Water is being accounted for, the government it encouraging judicious use, and funding is given for drinking water schemes. But productive-use schemes are completely overlooked. It is assumed that communities will somehow figure out how to access productive-use water on their own. And although there are private wells in most villages, it is the relatively wealthier farmers who own them. This points to a lack of awareness of the importance of small-scale productive use; most "agriculture" in Maharashtra is conceptualized as large farms. Plus, these private wells are responsible for much of the groundwater depletion problem the state is facing.

> *"MUS is not just a water supply scheme. It involves livelihoods for people."*
> —Social worker, SEVA

Even if the "choice" is truly up to communities to incorporate MUS into their projects as they wish, they need information to make that choice. If the idea had been fully embraced at the state level, the community would have been educated about the concept through the CBC or training organization. Supposedly, kitchen gardening was included in the information the SOs were meant to train the community about. But it is unclear the extent to which SOs actually promoted their cultivation. It became clear through the interviews that the information transfer through Jalswarajya/Aple Pani varied across each district and depended on how effectual the CBC and SOs were. Although a minimum standard of information was intended to be conveyed, the situation from district to district differed considerably.

Furthermore, even if there is adequate information transfer, community "choice" can be easily swayed. The assisting organizations (CBC, SO, and training organization) hold considerable power to shape a community's actions. For example, the chairwoman of the Women Empowerment Committee in Samundi was very keen to start a dairy in the village despite the high initial costs and inability to receive a loan. Her enthusiasm was not due to her own initiative. It was largely due to the local training NGO who had strongly encouraged the committee to establish a dairy.

In summary, too many limitations existed within the Jalswarajya/Aple Pani framework for MUS-by-design to materialize in Maharashtra. While it was a good opportunity to attach MUS efforts to the dissemination of a larger project, the project leaders never fully embraced the MUS concept. Moreover, without direct control over implementation of the projects, IDE was limited in its capacity to expand MUS. The Maharashtra experience showed the difficulty in advocating for the MUS concept through a government project: lack of direct input over implementation, an established relationship with the community, and real influence with the local NGO partner.

### RESTRICTIONS IN THE CULTURE AROUND WATER RESOURCE DEVELOPMENT SCHEMES IN MAHARASHTRA

There were also limitations embedded in the culture and prevailing water resource development paradigm in Maharashtra. Many organizations who were initially interested in the MUS concept and implementation dropped out once they realized that they would not receive funding for the projects. It was reiterated repeatedly during the interviews that the mentality regarding funding can be a difficult hurdle for execution. Because the government gives large sums of money for drinking water schemes, money is the only thing that "talks" with local NGOs and communities. When trying to propagate a new idea, particularly if it is attached to a state-level project like Jalswarajya/Aple Pani, the NGOs expect to get funding. If there is no funding attached, their interest level diminishes. It is also very difficult for organizations to get communities to participate in scheme cost and construction because they are used to being "given" water schemes. Through Jalswarajya/Aple Pani the communities are expected to contribute 10 percent of the cost (5 percent if they are tribal). Even though this percentage seems low, it is a new endeavor for the state to actually require funding from communities. Interestingly, Dilasa has somehow managed to convince communities to contribute around 40 percent on average in their projects. Sharing successful methods such as theirs should be further encouraged through Jalswarajya/Aple Pani.

Communities and NGOs are also inclined to construct new projects regardless of whether there is an existing scheme that could be renovated for less cost. Even though the Jalswarajya/Aple Pani project plans encourage the improvement of existing resources/schemes as the first action, those implementing the schemes have by and large ignored this standard. Instead, they opt to build new, and often expensive, systems.

## CONCLUSION

The MUS Learning Alliance in Maharashtra was mostly successful in establishing NGO networks in the three chosen districts as well as the incorporation of MUS into partner organizations' watershed projects. Unfortunately, government participation in the LA was less than anticipated. Whereas the LA was useful for expanding the concept of MUS to some extent and has resulted in some concrete outcomes, attachment of MUS implementation to Jalswarajya/Aple Pani encountered serious unforeseen setbacks. With few staff, IDE did not have the capacity to implement MUS projects independently. Consequently, IDE became an enabling organization instead of an implementing organization. From initial conversations with Jalswarajya/Aple Pani officials, the government seemed supportive of the concept and was allowing communities to decide whether to use water for productive use. Because the government sector is responsible for village water supply in Maharashtra, IDE staff felt that combining with a government program was the best vehicle for implementation. Furthermore, of all government programs, Jalswarajya/Aple Pani is a new wave in state-level thinking and the most focused on community-based decision making.

Due to IDE efforts, some villages are currently using or are planning to use some of the excess water productively. Moreover, it is possible that if IDE had presented the MUS concept during the planning phase of Jalswarajya/Aple Pani a few years earlier, the ability to create MUS-by-design schemes would have been greater. However, with a better understanding of the history of drinking water schemes in the state, the centralized and sectoral nature of the government structure, and the lack of desire within government to implement already-existing integrated water resource management policy, it is understood that true MUS-by-design was unlikely to come to fruition in this short timespan.

The Jalswarajya/Aple Pani projects do indicate a changing standard toward community-led water schemes. This provides fertile ground to sow the seeds of MUS in Maharashtra. The MUS project was a beginning step in raising awareness of the need to deliberately incorporate productive use. However, there is much work to be done. The productive-use component must be more deliberately included in existing efforts on water budgeting, source strengthening, conservation, and efficient water use. Furthermore, despite the stated purpose of Jalswarajya/Aple Pani to build the water-management capacity of the community, the government's own inability to embrace the productive-water-use component translated into incomplete knowledge transfer to communities. The only mechanism for communities to factor in productive use was exceptional community initiative or NGO encouragement. By drawing upon the idea of partner organizations to build pilot MUS projects in each district, concrete examples for MUS may lead to expansion of the idea. Then, the enabling environment of the government can be fully tapped. Full buy-in and an attitude shift of the state-level government is required for real scaleup in the state. With buy-in at the state level, implementation can then take place through the district-level human-resource infrastructure, drawing upon the knowledge and expertise of partner NGOs.

CHAPTER 14

# CONCLUSION

Photograph by Deepak Adhikari.

An abundance of lessons emerged from the MUS work in Nepal and Maharashtra, India. While the experiences in the two places were incredibly different, several common threads emerge, albeit with distinctive situational spins.

## MUS EXTENDS INTEGRATED WATER RESOURCE MANAGEMENT

Perhaps the simplest emergent theme is that MUS is not a new concept for rural villagers in either Nepal or Maharashtra. In both regions, communities have found ways to achieve their own integrated water resource management by combining various "projects," either brought to them via external implementers (the government or NGOs) or accomplished via their own efforts. As demonstrated most clearly in Kikwari, but also in Samundi, Chhatiwan, Krishnapur, and many other MUS villages, communities piece together various financial and physical resources over time to meet their water-use needs. Kikwari (chapter 10) used four successive projects over the past twenty years to gain village access to groundwater for domestic use: through a drinking water project; by augmenting groundwater capture by constructing runoff barriers; by capturing greywater and recycling it for productive use; and through further augmentation of the water supply through Jalswarajya, to which MUS is attached. Samundi (chapter 11) also combined multiple projects: they protected the nearby forest land and constructed small check dams on the nearby river and recharge pits at each household for groundwater recharge; they banned open defecation and built toilets; and they increased their water supply through Jalswarajya. In Chhatiwan (chapter 3) the community lobbied the local VDC council to provide them with a half-inch pipe to deliver water directly from the source to their community for domestic use and later incorporated this pipe into the MUS system. In Krishnapur (chapter 5), the community took these steps: used their branch of a previously existing farmer-managed irrigation system; lobbied the DoI to line the canal for additional water; built household storage to allow flexibility in use; and tapped a small nearby spring to augment the water supply.

Yet, MUS takes this community-led integrated water resource management one step further by formalizing the community-management structure into a Water User Committee (WUC) in Nepal and Village Water and Sanitation Committee (VWSC) in Maharashtra. This ensures access of disadvantaged groups (women and lower castes) and builds the overall community's capacity to access both physical and financial resources to accomplish their water-use goals. It also engenders a greater level of buy-in from the community for system care: because MUS provides for a combination of domestic and productive needs, all community members have an increased stake in its smooth operation. And with the rise in income from the productive-use component, households can better afford the operation and maintenance costs of the system. The importance of the financial boost of the productive-use component cannot be understated; i.e., the connection with high-value crop production and marketing is critical (as seen clearly in the Nepal cases—chapters 3–5).

Whereas MUS is not a new concept for communities, it is a shift in approach for water resource development implementers. Despite the sectoral nature of water resource development in the country, the Nepal program was able to achieve significant buy-in from implementing partners with a single-purpose mandate. Because MUS inherently requires the involvement of multiple sectors, players within the government who largely do not coordinate were brought together in Nepal—the Ministry of Agriculture and Cooperatives; Ministry of Finance; Ministry of Women, Children & Social Welfare; Ministry of Local Development; and the Department of Irrigation. All of these government participants regularly communicated with NGOs, local community groups, and WUCs. Fortunately, MUS coincided in Nepal with a larger movement within the Department of Irrigation called the Nonconventional Irrigation Technology Project. Their interest in microirrigation opened the door for MUS and generated great respect for the fledgling department within the DoI at a time when it was seeking to build recognition and respect. Witnessing the positive impact on communities improved NITP staff morale and gained the department accolades.

## BLEND OF COMMUNITY AND INDIVIDUAL ACTION AND BENEFIT

Another reason for increased community buy-in is the important blend of community and individual action that MUS achieves. All community members are tied in to the MUS system through use of a common resource, reception of water service, and participation in the WUC/VWSC. The entire implementation process creates community cohesion and effective community management of a shared resource. But MUS also provides water for individual household productive use. Households can choose how they wish to use their water allocation from the system. In both Nepal and Maharashtra, IDE encouraged use of microirrigation kits on small plots/kitchen gardens for growth and sale of high-value crops. Households could choose whether to purchase the kits or not with their own money. They chose the size of kit they desired and how much water to allocate for its use. Thus, individual households benefited from the increased consumption of vegetables as well as the income vegetable cultivation and marketing brought them. Furthermore, the community in turn benefited from the increased ability of households to pay for the operation and maintenance costs of the system.

In Nepal, the combined individual/community action also sometimes led to a change in water-use behavior. As evidenced by the situation in Senapuk, the connection between closing taps and availability of water in the system was an important driver toward water conservation. By connecting domestic and productive use, the incentive to conserve is higher. As a community system, community members can keep one another's water consumption in check. Hence, individuals are encouraged to close community taps instead of letting water consistently flow, as was the common practice prior to MUS implementation. Conversely, water conservation action was not observed in communities where IDE only supported individual household microirrigation technology use. Thus, it appears that collective action is required to encourage individual conservation behavior.

The MUS systems in Nepal also have an important connection to the situation of the migration of male villagers to work abroad and send home remittances. As in Senapuk (chapter 4), women who were the current heads of their households in MUS villages found increased financial independence through the cultivation and sale of vegetables and improved social standing through participation in the WUC. And given the inconvenience and stress on the family when men are away for most of each year, the productive-use opportunity opens an option for income generation that will enable some to earn more by staying home.

In Maharashtra, the individual/community action linkage takes on a different, but no less important, implication for mitigating the acute effects of groundwater overdraft in the state. Irrigation for agriculture in the state has historically been through either large-scale irrigation-canal systems built by the government or groundwater abstraction of wealthy farmers through digging wells or drilling of individual household bore wells. On the other hand, domestic water provision has predominantly been through community wells. Therefore, irrigation was largely an independent enterprise while domestic water provision had greater community consequences. However, with recent severe droughts and overabstraction of groundwater from individual household wells, community water planning is becoming increasingly important and increasingly practiced. NGOs and the government are beginning to train communities to budget their water resources in order to: raise the level of understanding of the resources they have available; develop ways in which to recharge the groundwater; and encourage efficient and equitable water use. Unfortunately, due to the historical separation of domestic and productive-use provision, productive-water use has largely been excluded from community water budgeting efforts, leaving individual households to continue depleting the groundwater reserves. The MUS concept is a positive step forward for Maharashtra communities because it incorporates the missing productive-use component into water budgeting. Consequently, the community can choose to allocate a set amount of water to farmers to prevent overuse of the resource. This in turn will protect the source for much-needed domestic purposes as the population increases. It also allows the community to encourage the cultivation of less-water-thirsty crops. Kikwari (chapter 10) is a good example of a village that has begun to make these connections between individual and community action and efficient use of available resources. Through a visionary farmer who leads the VWSC in the village, they have undertaken numerous groundwater-recharge activities; collected greywater for cultivation of crops on community land; allowed a women's SHG within the community to lease community land for their own crop cultivation; and encouraged the shift toward production of less-water-thirsty crops. Hopefully as the MUS concept spreads, other villages will make this connection. For future MUS efforts, the association between individual and community action should be made explicit.

## IMPORTANCE OF SYSTEM/PROJECT OWNERSHIP

SIMI implementation staff indicated that the difference between MUS and government water resource development projects is real community ownership. The importance of system "ownership" is undisputed. However, the actuality of what is meant by "ownership" differs widely. IDE considers communities to own their systems if they have complete control over the future of the system. In order to have complete control over the system's future, a community must manage its construction, have the right to choose who uses the system, make operation and maintenance rules, and be able to enforce the rules. In systems where government initiates the system, even if "handover" for operation and maintenance occurs once the system is built, control over who has access to the system remains with the implementer. In Nepal, the communities were required to negotiate with neighboring communities to ensure legal rights to use the water source or a portion of the source. They were also responsible for lobbying other NGOs and government agencies to contribute matching funding. Communities contributed on average 47 percent of the total system costs (cash, local materials, and all unskilled labor). In addition, individual households purchased microirrigation kits at full cost. The WUC was responsible for ensuring equal contribution from each household, and if wealthier households chose to opt out of labor contribution, they hired less wealthy households to contribute for them. This substantial input—negotiation for rights; lobbying for partner support; and cash, material and labor contribution—built strong community pride in their systems, ultimately increasing desire to keep the system well functioning.

In Maharashtra the communities have greater control over system construction than in previous state-run domestic water projects, but too many restrictions remain for true ownership. The state-level bureaucrats running the Jalswarajya/Aple Pani projects established specific rules of implementation, set lists of NGOs and contractors that could be "hired" by the community for various roles, set system designs the engineers were allowed to choose from, etc. This left too few real choices for the community. Additionally, Jalswarajya/Aple Pani relies far too heavily on NGOs to build the capacity of the community without the adequate measures to ensure their success. There was no quality control to ensure that the NGOs were actually transferring skills successfully, and remuneration was far below what was needed to ensure NGO initiative and sufficient support. Thus, the communities who were lucky enough to secure exemplary NGOs were more successful than those who were not. Furthermore, the Jalswarajya/Aple Pani systems in Maharashtra were much larger and more expensive than those in Nepal due to larger populations, the need for pumping of groundwater, and the fact that entirely new projects were built without incorporation of preexisting infrastructure. The community was responsible for contributing 10 percent of the total cost (5 percent for tribal communities), while the rest was provided by the state. The community hired contractors and NGOs from the predetermined list to design and build the system.

Determining rules of distribution is a critical piece of system ownership. Interestingly, in both Nepal and Maharashtra, the "equal share" concept from domestic-only systems supersedes other distribution rules seen in irrigation-only systems. In irrigation-only systems, it is not uncommon to base allocation on land area or share of system contribution per household. In Nepal, since the system was servicing both domestic and productive needs, all households were expected to contribute equally to the system and thus receive the same share of water, regardless of the amount of agricultural land they wished to irrigate. All communities applied the use of flow regulators to ensure equal distribution despite different outlet elevations. This equity-of-use rule is more flexible when water is abundant (as seen in Chhatiwan where households simply take as much water as they wish for both domestic and productive uses). However, when water becomes scarcer, the rule is more strictly enforced. In Krishnapur, the WUC determines the water schedule depending on the time of year (based on the flow in the canal and spring). Communities also purchased their own homestead storage to increase their flexibility of use during the interim periods between water deliveries.

Ownership also comes through choice. In Nepal the communities jointly planned system design with SIMI. The systems are flexible enough to allow for adaptive management as need and resource flow shift both throughout the year and over multiple years. This allows them to adjust system management over time. However, SIMI engineers still had significant input into system design. Greater community control could be accomplished if SIMI were to provide a wider menu of options. This would increase community flexibility to choose between system cost versus more intensive management.

Since IDE was not the direct implementer in Maharashtra but worked within a state-level domestic water project, the scope for MUS was limited and community ownership was not fully reached. A combination of all aspects of water resource use and recharge is needed. Drawing on NGO watershed-development experience (water budgeting and groundwater recharge) and government experience building domestic systems, in combination with efficient and equitable allocation for multiple uses, would truly achieve MUS. However, the reality is such that MUS may need to be achieved through state-level programs. Thus, using the extra water for the projected population growth that is currently in the system for productive use, such as kitchen gardens, is a good way to move toward MUS within the existing constraints of large-scale domestic provision.

## COMPARISON OF THE TWO LEARNING ALLIANCE APPROACHES

The Learning Alliance (LA) approach was used in both Nepal and Maharashtra but with somewhat different outcomes. Although the LA was important for MUS development in both places, it was in some ways more successful in Nepal because of the way it was conducted. In both places district and national (or state level in Maharashtra) workshops were held. However, in Nepal there was greater government involvement than in Maharashtra, which relied mainly on NGO partners.

The limitation of IDE's small staff in Maharashtra greatly impacted the form that the LA took. With constraints on direct implementation, IDE staff decided to begin MUS work in Maharashtra through the LA approach. Staff focused on encouraging the concept with partner organizations to implement MUS themselves or approach communities they were working with through Jalswarajya/Aple Pani to incorporate a MUS component. While this approach generated some level of success and interest with NGO partners, it was restricted in its scope. Several NGOs were interested in MUS until they realized that no funding would be generated. Likewise, NGOs were bounded by the structure of the Jalswarajya/Aple Pani project. However, the Jalswarajya/Aple Pani program heavily emphasizes the role of NGOs in the project, acting as both support organizations (SOs) and capacity building consortiums (CBCs). Thus, building partnerships with these organizations is critical for infusing MUS into project implementation by ensuring that communities are made aware of the full range of choices. The supportive role played by NGOs is also essential for building the capacity of communities to push for the incorporation of all of their needs into future projects, or at minimum to better link various projects to supply their needs.

In Nepal, the LA and MUS project implementation reinforced each other. As mentioned above, the communities were responsible for obtaining matching funds from partner organizations, both NGOs and government agencies. This search for matching funds cemented partners who were then encouraged to be involved throughout the implementation process. These partners and additional organizations were invited to attend district and national-level workshops. Workshops were important for showcasing community-group representatives to individuals who had not yet visited MUS sites and for discussing potential mechanisms for scaleup. Key agency officials were also part of the SIMI Advisory Board, keeping them regularly involved in the progression of MUS over the years.

Critical to this involvement, however, was the fact that actual MUS systems were built before the LA approach was initiated. Field visits of partners to these concrete (and successful) examples of MUS were crucial for garnering support of future MUS systems and LA activities. When comparing the propagation of the MUS concept in India versus Nepal, it becomes clear that seeing MUS in action is much more compelling than simply explaining the concept. In fact, the most striking example of this is the visit of an Indian partner NGO, Dilasa, to Nepal. As part of a different Challenge Program on Water and Food project, Dilasa staff traveled to Nepal and were taken on a field visit to MUS sites. Although Dilasa had been part of the LA prior to their visit, seeing the MUS-by-design systems in Nepal turned them into instant advocates of the concept. Upon return to Maharashtra, they were so excited by MUS-by-design that they sought out two separate sources of funding for implementing their own projects.

On the other hand, perpetuating the MUS concept by encouraging field visits to existing MUS-by-design projects encourages viewers to equate the MUS concept with what they see. This limits their vision of MUS to what has taken place in the site they visit. This makes it difficult to encourage creativity in conceptualizing other possible manifestations. In both Maharashtra and Nepal, partners tend to view MUS as simply drinking water and microirrigation of small plots of land. However, some emerging projects in Nepal are expanding this concept to include microhydropower for grain milling and electricity production as well as other components.

## LINKAGE WITH DECENTRALIZATION EFFORTS

In both India and Nepal there has been a recent trend toward decentralization of government, particularly when it comes to infrastructure development. Through the Nepal LA, participants discussed the potential for MUS scaleup in the country. Many individuals felt that long-term sustainability of MUS systems would only occur if MUS were to be imbedded within the government structure itself. The general consensus was that the district and local governments (DDC/VDC) should be in charge of MUS implementation with various government line agencies and NGOs providing funding and technical support for the various components of MUS. This mechanism for MUS scaleup was recently accelerated when the Ministry for Local Development added MUS to their fund-allocation guidelines. Inclusion of MUS in the guidelines makes it an official government development activity, authorizing the district government to provide funding to village governments for MUS projects.

For Maharashtra, decentralization is transferring greater control to the local government (Gram Panchayat—GP). Although the state-level government still has somewhat of a top-down approach, Jalswarajya/Aple Pani is the first step toward strengthening the involvement of the community in water resource development. The GP, in conjunction with the VWSC, is primarily responsible for project implementation in each village. However, to overcome the barriers to scaleup and have real MUS-by-design that is truly community-led, greater decentralization of the process would be required. The state level would need to provide much greater flexibility in the way the projects are implemented to place actual control with the community and local government. On the other hand, if MUS is to be incorporated into domestic-water-development programs such as Jalswarajya/Aple Pani as they are designed today, then achieving full buy-in from the state level is critical for scaleup of MUS in the state.

## DIFFERENT MUS APPROACHES NEEDED FOR VARYING CONTEXTS

Ultimately, the comparison between the Nepal and Maharashtra MUS work shows the need for different MUS approaches for varying contexts. One factor that impacts the system design is the location of land in relation to homes in the village. In Nepal, the bari land upon which they were growing vegetables with microirrigation kits was usually near the homes. This made the combination of domestic and productive water more feasible. However, there were some households who had bari land much further from their homes. These households were generally only provided domestic water because provision of productive water was too cost prohibitive. In Maharashtra, the villages are much more densely populated, leaving little land to cultivate for kitchen gardens except at the edges of the village. Agriculture is also generally larger scale and conducted on plots further away from the village. This makes MUS-by-design more complicated and expensive and highlights the need for greater creativity. Kikwari and Samundi already display this type of innovation through greywater filtration and reuse on community plots, irrigation of community land by women's SHGs, creation of the tribal community goat farm, etc.

The landscape and type of water resource available heavily impact system design and cost factors. Nepal was largely so successful with MUS implementation because there was either existing infrastructure that had excess water for use (i.e. Krishnapur's use of the farmer-managed canal system and Chhatiwan's use of the source already shared by multiple communities for drinking water) or small springs that had yet to be tapped (i.e. Senapuk's MUS source and the additional source tapped by Krishnapur to augment the canal supply). The use of excess from existing systems reduced infrastructure costs. The use of springs allowed for gravity-fed systems, preventing the need for expensive pumping. Consequently, the small systems in Nepal allowed for impressive impact with low investment and use of sources that were previously thought (by government and NGOs) to be too small to be useful. The low investment with important positive impacts for communities—increased income; improved nutrition and health; empowerment of women; reduction of time spent in water collection; skill building of community members; increased school attendance, particularly for girls; increased water conservation; and shifting caste and gender power dynamics—increased the buy-in of all stakeholders. See chapters 3–6 for more on project impacts.

Maharashtra, on the other hand, has mostly groundwater or streams to use for MUS. This requires construction of a large overhead storage tank, pumps, and the cost of running pumps. Overall, the costs are much higher for this type of system. Due to the need for use of groundwater, greater scarcity of water in general, and the depleted groundwater resources in the state, groundwater recharge efforts factor heavily in Maharashtra's water resource development work. Water budgeting and allocating set water quantities for various uses in addition to the encouragement of efficient water use (as in use of microirrigation and moving away from sugarcane cultivation) can ensure future water availability for all uses. In Maharashtra, water budgeting and groundwater recharge has already become critical, but Nepal is not immune to overuse of resources. As Nepal begins to use more of the small springs in the hills, a larger plan for water use will need to be conceptualized and implemented in the country to ensure that those downstream do not suffer water shortage. And MUS implementation in Maharashtra can guide MUS implementation in the flatter region south of the hills in Nepal, the Terai.

Regardless of the system design and natural-resource limitations, experience in Nepal and Maharashtra has shown that combining MUS with microirrigation creates a powerful duo. Microirrigation ensures the ability to grow more "crop per drop" and conserve the much-needed resource. As population growth causes resource demand to grow, cognizance of broader policies that encourage certain types of crops (i.e. sugarcane in Maharashtra) must be part of the MUS movement.

## Notes

**Part 1 Introduction**

1. The Global Lead partners on the CP-MUS project were the International Water Management Institute (IWMI); IRC International Water and Sanitation Centre, The Netherlands; International Development Enterprises (IDE), USA; and Khon Kaen University (KKU), Thailand. Each Global Partner worked with local partner organizations in five different river basins around the world: the Andes, the Nile, the Indus-Gangetic, the Mekong, and the Limpopo.
2. Ujyalo aims to strengthen support for the victims of conflict and conflict-affected communities through an integrated community-level program that combines economic and social support activities designed to address the physiological and economic consequences of Nepal's conflict. The BDS-MaPS project, funded by USAID and implemented by a consortium of INGOs and private businesses, aims to increase income opportunities of 22,000 smallholder farmers and gatherers in six target districts of Nepal by boosting production, improving quality, and increasing demand for nontimber forest products. BDS-MaPS PRIME is focused on women entrepreneurs and is partially funded by USAID. The subsectors under this program are based on their adaptability to women producers and include high-value crops like vegetables, poultry, and mobile retail shops.
3. For the purposes of this book, MUS will be used to mean the Multiple Use Services project funded by the Challenge Program on Water and Food and also multiple-use water services in the general sense.

**Chapter 1**

1. Improved access is defined as having one of the following: household connection, public standpipe, borehole, protected dug well, protected spring, or rainwater collection.
2. Computed using data from FAOSTAT; accessed by www.faostat.fao.org
3. Clarified (rendered) butter made by simmering unsalted butter until all water has boiled off and protein has settled to the bottom.
4. In the 1970s and '80s the World Bank loaned a great deal of money to the government of Nepal for rural water supply infrastructure. Due to mismanagement of funds by the government, the World Bank ultimately closed down all of these loans. In the 1990s the World Bank tried a new tactic with the Fund Board and began working with NGOs as implementers, using government line agencies for budgetary and regulatory functions. Because this was prior to government decentralization, there were no functioning VDCs or DDCs to work with directly at the time.
5. Dr. Prachanda Pradhan , e-mail message to author, May 27, 2007.

**Chapter 2**

1. SIMI divides each district into three "pockets" for project operation.
2. Local NGO implementing partner in Kaski District.
3. This amount is recommended by UNICEF and Nepal Department of Drinking Water Supply and Sanitation guidelines as the standard for domestic water systems.
4. GOs are government organizations including the various line agencies at the district level.

5. In Nepal they often refer to "local government" to represent the VDC and DDC.
6. A method of ensuring the plants receive their required nutrients.
7. Agricultural interventions include all of the production trainings provided in the trainings list in chapter 2 as well as the cost of social mobilization and training for input service providers on marketing.

**Chapter 3**

1. In the middle hills of Nepal it is common practice to eat two meals per day. Therefore, "food security" was defined in all three case studies as being able to produce enough food for two full meals per day for the whole household.
2. Through area microirrigation programs like SIMI, interest in obtaining technical knowledge has increased in the region, and Dal Bahadur Disa is now providing technical support on behalf of a local NGO called Social Resource Development Center.
3. In Nepali, *mul* means "spring."
4. As mentioned above, this particular household had a family member in the hospital, greatly increasing healthcare costs.

**Chapter 4**

1. A scholar, a teacher, particularly one skilled in Sanskrit and Hindu law, religion, and philosophy.
2. The Vedas are the main scriptural texts of Hinduism.
3. This includes income in-kind for religious workers. Exchange labor and other miscellaneous in-kind income was not measured.
4. Offtakes for irrigation were built closer to the agricultural land for both the households using the old domestic system and households using the domestic portion of the new MUS system so that they did not need to carry water from domestic tapstands for irrigation.
5. 600/250 = 2.4 liters/m$^2$. Since 1 mm of water depth per m$^2$ area is 1 liter of water/m$^2$ area, it results in the equivalent of 2.4 mm of water depth applied uniformly to a 1 m$^2$ area. In practice the applied water is concentrated near the plant, increasing the percentage of applied water available to the root system.
6. Because of the landslide years back, they are not actually irrigating this land, but they believe they retain some right to the stream's use.
7. This figure was obtained from household interviews with 12 households in Senapuk and a focus-group discussion with the poorest households in the village.
8. The wage labor rate in the Senapuk area at the time of MUS construction was NPR 120/day for men and NPR 100/day for women. Therefore, using the women's wage labor rate, they are saving NPR 19/day for 1.5 female labor hours saved.

**Chapter 5**

1. According to the World Health Organization's 2005 Nepal Country Profile, the Insect Borne Disease Control Programme was launched in 1954, supported by USAID. In 1958, the government of Nepal launched a malaria-eradication program. It was realized in the 1970s that eradication was not possible, so the program reverted to malaria control in 1978.
2. Agricultural income includes sales of fruit, vegetables, livestock, and livestock products like ghee and milk.

3. Thick wool used to make shawls.
4. The *chokidar* is hired during the mass meeting where payment is discussed and the entire group of water users is involved. This democratic and transparent way of setting up group rules is one of the ways that farmer-managed irrigation systems gain compliance.
5. It was decided that since the primary water supply was surface water from the Karre Khola stream, it would not be used for drinking. If water is clean enough to drink, it is definitely clean enough for use with microirrigation systems. However, water that is clean enough for microirrigation may not actually be clean enough to drink. Bacteria and viruses as well as other contaminants could be present in acceptable microirrigation water. In the hills of Nepal, spring water is considered drinking water quality, and surface canal water is considered lower quality.
6. To flush a pour-flush toilet requires about four liters. Assuming it is used once/household member/day and in Krishnapur there are on average six members in a household, then about 24 liters/household/day are needed for toilet flushing. Hand washing requires around 1 liter/capita/day, so six liters/household/day. Therefore, each household requires roughly 30 liters per day at minimum for toilet flushing and hand washing.
7. The central government, with ADB funding, is expanding the water supply for small towns in Nepal. Birendranagar was selected as one of the pilot small towns. The new water supply system will pass through the Karre Khola Valley, and plans include provision of drinking water from the town system. This will greatly improve the quality and reliability of the domestic water supply for Krishnapur as well.

**Chapter 6**

1. In Nepal, water use for animal care is included in domestic water need.
2. During the time of household surveys in Krishnapur the community had only had one growing season. Production values from this growing season were multiplied by two to get a rough figure for comparison with Chhatiwan Tole and Senapuk, both having had two growing seasons when interviewed.
3. Information from field visit to Lele scheme in Lalitpur District on 2/27/07.
4. In the caste system, a Dalit, often called an Untouchable, or an outcaste, is a person who, according to traditional Hindu belief, does not have any *varnas*. Varna refers to the Hindu belief that most humans were supposedly created from different parts of the body of the divinity Purusha. The part from which a varna was supposedly created defines a person's social status with regard to issues such as who he or she may marry and what jobs he or she may do. Dalits are at the low end of the caste system.
5. As the liaison between the community and all other stakeholders, the Social Mobilizer/Community Mobilizer is truly the gateway to the community and the most keenly involved in conflict resolution throughout the process. Their role is critical to MUS success.
6. In-line flow-regulator technology is widely used in Nepal's rural drinking water programs where significant elevation difference between tapstands causes large discharge-rate differences. These have been incorporated in MUS projects where elevation is an issue to ensure equity in all distribution networks.
7. These are the same figures that were used in MUS demand calculation.

8. The cost for the most popular systems—small and very small—can be recovered in one agricultural season as evidenced by field observation of all IDE/SIMI programs.
9. This information came from the focus-group/meeting with IDE/SIMI Community Mobilizers and Social Mobilizers in Tansen on 3/22/07.
10. This is partly due to the large number of men working outside of the village and partly due to caste. There is stigma attached to a male Brahmin carrying a load of vegetables to market.
11. Janjati are a low-income ethnic group.

**Chapter 7**

1. For the case of Lalitpur district, the NITP within DoI was the major partner, mostly due to the proximity of Lalitpur to Kathmandu. There was no SIMI district team in Lalitpur; instead the central-level SIMI staff were entirely responsible for Lalitpur district schemes. Their close connection to the NITP led to this partnership.
2. As mentioned previously, water used for livestock care is generally considered to be one of the domestic water uses in Nepal.
3. The Poverty Alleviation Fund is a World Bank–funded autonomous project within Nepal that aims to improve access to income-generation projects and community infrastructure for the groups that have tended to be excluded by reasons of gender, ethnicity, and caste, as well as for the poorest groups in rural communities.
4. In the decentralization process, the Ministry of Local Development came out the winner because it held the purse strings at the district level. This was resented by other ministries.
5. As mentioned in chapter 1, DDCs receive technical support from the District Technical Office, which is overseen by DoLIDAR. DoLIDAR partners with other line agencies as needed.
6. DDCs and VDCs can plan their development activities autonomously once given funds from the central level based on decisions of the assembly; the assembly members are the participants of local political parties, government officials, etc. At the VDC level the community participates in the VDC assembly and can demand the development activities in their area; assemblies are held once a year, but right now it is difficult to organize them because those in the eight-party alliance tend to support only their party interests. The VDC secretary must call the planning assembly where all the VDC residents, party members, etc. meet. In some districts throughout 2007 they had no budget plan because they had not convened.
7. They saw the Women Development Department as key for social mobilization because they have a network of women Self Help Groups at the community level throughout the country, which has higher coverage than any other line agency.
8. In NITP's estimation, DoLIDAR should be responsible for the drinking water component instead of DWSS because of the size orientation of the two organizations.
9. For more information about cognitive dissonance, please reference Cary Coglianese, "Is Satisfaction Success? Evaluating Public Participation in Regulatory Policymaking" 2002, John F. Kennedy School of Government, Harvard University, Research Working Paper 02-038.
10. Cash contribution includes money and nonlocal materials such as piping donated by government organizations. The cash is used to purchase any necessary external materials additional to those donated.

11. Manohari Development Institute is a local NGO of the Makwanpur District.
12. The Development Committee within the DDC integrates all district development activities under one umbrella committee.
13. The suggestion was for all cash contribution to be given directly to the WUC and be placed in the WUC bank account (discouraging material contributions and encouraging cash-only contributions). The community (via the WUC) would then be responsible for material purchase, hiring of skilled labor if needed, etc. If the government agency prefers to give materials instead of cash, the community would work directly with the government instead of liaising through other partners. Helvetas-Palpa suggested that the community should be made responsible for purchasing the nonlocal materials instead of SIMI so that they would gain more technical knowledge. For example, if the community had a maintenance problem in the future and needed materials, they would then have had experience purchasing quality materials previously.
14. As mentioned before, the 1999 Local Self Governance Act in Nepal was an attempt to shift the government toward decentralization.

**Part 2 Introduction**

1. The initial idea was to link different water supply projects and sectors to integrate water resource management and planning on a microbasin scale comprising a group of villages. However, not much of this initial concept has come to fruition, and the project has ended up mostly as a domestic water project.

**Chapter 8**

1. A "habitation" is a cluster of families within a village with a total population of at least 100. An average of 20 families (with an average of five members) live in a habitation. In hilly areas a habitation can have a population of less than 100.
2. Generally, a Tehsil consists of a city or town that serves as its headquarters, possibly additional towns, and a number of villages. As an entity of local government, it exercises certain fiscal and administrative power over the villages and municipalities within its jurisdiction. It is the ultimate executive agency for land records and related administrative matters.

**Chapter 9**

1. Livestock water began being included in system design in 2003. Ahmednagar district had a huge drought between 2000 and 2003, and the government was required to provide shelters for livestock to water and feed them. In order to prevent this from happening again, the donor (KfW) suggested that they include a livestock requirement within the water supply schemes. The calculations are 40 liters per day for one bullock/cow/buffalo, 40 liters per day for 100 poultry, and 40 liters per day for 10 goats or lambs.
2. The Gram Sabha is the body that encompasses every voting individual in the village. It can also be used to refer to a meeting held with all villagers present.
3. A Sarpanch is the democratically elected head of the Gram Panchayat. He, together with other elected members, constitute the Gram Panchayat. The Sarpanch is the focal point of contact between government officers and the village community.

4. Scheduled Castes and Scheduled Tribes are Indian population groupings explicitly recognized by the Constitution of India as being previously "depressed."
5. Static lift is the vertical distance between the source and discharge levels in a pump installation.

**Chapter 10**

1. Using a conversion rate of 40.8 Indian Rupees per U.S. dollar.
2. The Nadep method of composting was developed by Shri N. D. Pandhari Pande from Maharashtra. The process facilitates aerobic decomposition of organic matter.
3. Interestingly, this SHG has the most tribal members. Eight are tribal women and two are nontribal.
4. Chikungunya is a relatively rare form of viral fever caused by an alphavirus that is spread by mosquito bites from *Aedes aegypti* mosquitoes.
5. Water often pools at public taps and can create mosquito breeding grounds.
6. SOs get paid INR 70 per person in the community for the entire project period regardless of how much they do. Some projects have been under construction for two years. And they get the money from the community in phases, making it difficult to regularly send field staff out to assist the community.

**Chapter 11**

1. Paan is a type of Indian digestive, which consists of fillings wrapped in a triangular package using leaves of the betel pepper and held together with a toothpick or clove.
2. The papad is a thin South Asian wafer, sometimes described as a cracker or flatbread. The recipe varies from region to region and in fact from home to home, but typically it is made from lentil, chickpea, black gram, or rice flour.
3. Using a conversion rate of 40.8 Indian Rupees per U.S. dollar.
4. The Industrial Technology Institute gives hands-on job training to students who have completed the tenth standard for various industrial skills such as mechanics, electronics, welding, etc.
5. Nagli is an indigenous cereal grain.

**Chapter 13**

1. A project funded by the central government for selected districts in which they bring technologies to rural farmers and provide agriculture marketing information.
2. This project is funded by the World Bank and in a similar fashion to Jalswarajya. The focus is on community participation and the capacity building of Water User Associations.
3. 1000–2000 engineers from all sectors come to these conferences annually.
4. As mentioned in chapter 8, the District Collector is responsible for coordinating all government departments at the district level.
5. An adjoining district to Aurangabad where Dilasa is working.

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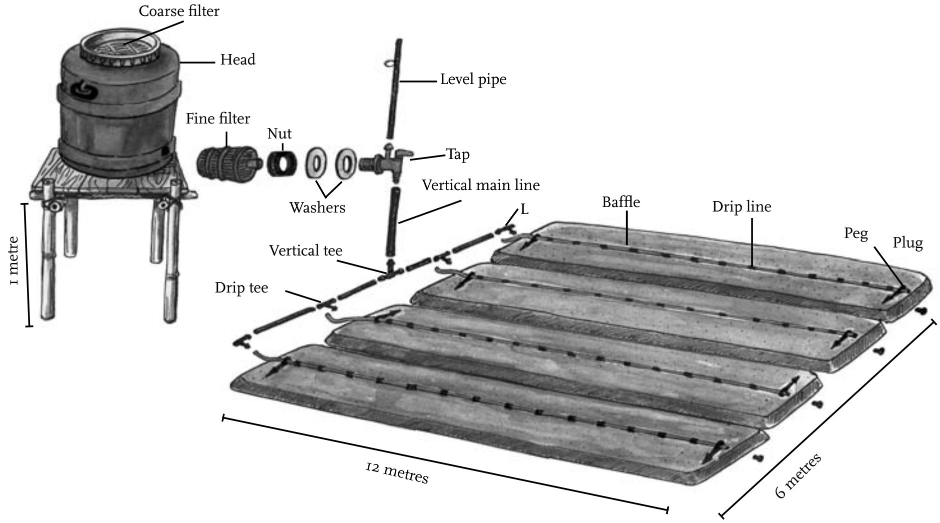
Micro Irrigation Systems

# SIMPLE DRIP IRRIGATION SYSTEM

*Appropriate irrigation technology for smallholder farmers*




## Components and specifications

| Component | Size | Description |
|---|---|---|
| Head Tank | 50-200 liters, depending on kit size | Water storage container |
| Filters - coarse, screen, and fine | | The coarse filter removes particles greater than 2 mm; the screen filter is just underneath the coarse filter and catches particles smaller than 2 mm; the fine filter catches all remaining particles |
| Mainline | 12-14 mm, depending on kit size | Runs water from the storage container to the submain line |
| Lateral drip pipes | O.D. 8 mm, 12 m long, 20 drippers per line | Perforated every 60 cm to make an orifice dripper |
| Level pipe | | Small piece of transparent tube attached to the tank outlet that allows user to observe water level in head tank and helps air trapped in pipe network to escape |

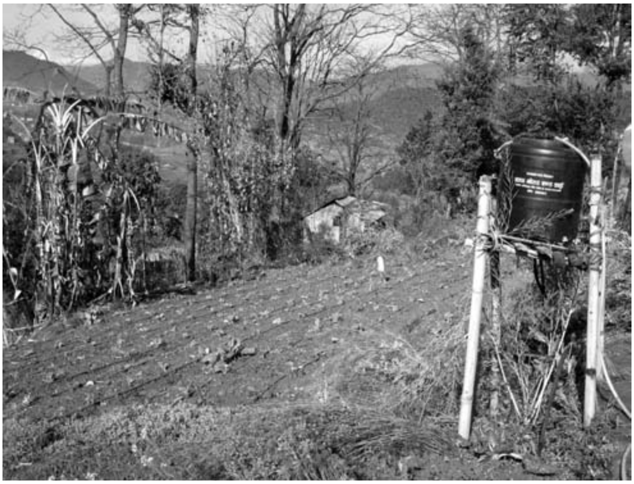
## System features

- Available in different sizes
- Simple to install and use
- More crops irrigated with less water
- Reduced time spent irrigating
- Low investment with high returns
- Can be used for fertilizer application
- Reduced weed growth
- Expandable design

System benefits compared to traditional irrigation

- Water Efficient: Less water is required to irrigate the same area
- Higher Yield: Higher yields and better product quality can be achieved
- Fertilizer Savings: Soluble fertilizer can be passed through the drip kit, increasing application efficiency and evenness of distribution
- Cost Savings: There is no need to use an electric pump because the system uses gravity for pressure.
- Terrain Flexibility: It can be used on slopes where traditional irrigation is not possible.

# SIMPLE DRIP IRRIGATION SYSTEM



## Size and Technical Parameters

- All components are manufactured from high quality PVC and plastic for durability
- A row spacing of 1.2 m is used with in-line dripper spacing of 60 cm for continuous wetting of crops
- The average discharge is 2.25 liters per hour

| System Size | Very small | Small | Medium | Large | Very large |
|---|---|---|---|---|---|
| Command area ($m^2$) | 90 | 125 | 250 | 500 | 1000 |
| Number of drippers | 80 | 120 | 240 | 480 | 960 |
| Number of lateral pipes (each 12 m in length) | 4 | 6 | 12 | 24 | 48 |
| Size of head tank (ltr) | 50 | 50 | 50 | 100 | 200 |
| Pressure head (m above ground level) | 1 | 1 | 1 | 1.5 | 2 |

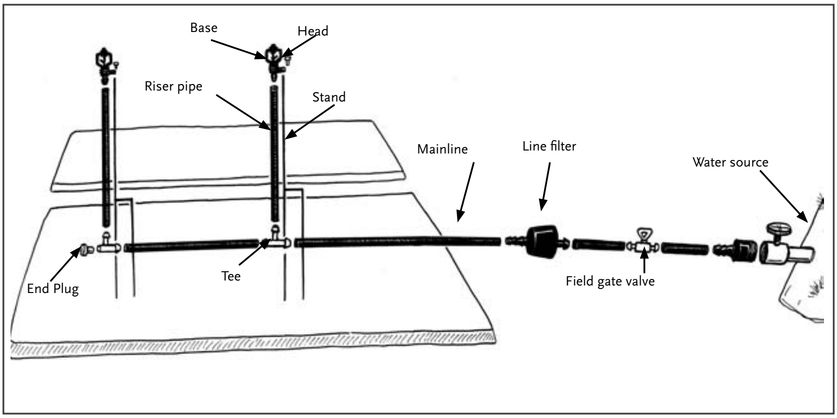
## Cost

Prices fluctuate according to region and date. Please see the price list at www.ide-international.org/library/techindex.php or call IDE/Nepal at Tel: 01-552-0943 for more information.

Micro Irrigation Systems

# SPRINKLE IRRIGATION SYSTEM

*Appropriate irrigation technology for smallholder farmers*




## Components

| Component | Description |
|---|---|
| End plug | Plugs the end of the pipe to prevent water leakage |
| Tee | Used to distribute water to two different paths |
| Stand | Maintains the uniformity of water precipitation |
| Riser | Pipe that takes the water up to the sprinkler head |
| Base | Provides support to the sprinkler head |
| Sprinkler head | Sprays the water |
| Mainline | Supplies water to the head through the riser |
| Line filter | Filters the physical particles that can clog the sprinkler out of the water |
| Field gate valve | Used to regulate water pressure and control water flow through the pipeline |

## System features

- Fully pre-assembled technology
- Low-cost, durable, and shiftable in the field
- Easy to install, operate, and maintain
- Suitable for short, closely grown crops
- All components are manufactured from high quality PVC and plastic for durability
- Operates a greater number of sprinkler heads with lower pressure than other sprinkle systems on the market.
- Each sprinkler head has a discharge of 75 liters per hour
- The system comes with a one-year warranty

# SPRINKLE IRRIGATION SYSTEM

### System benefits compared to traditional irrigation

- **Water efficient:** Less water is used to irrigate the same area
- **Higher yield:** Higher yields and better quality products can be achieved
- **Terrain flexibility:** It can be used on slopes where traditional irrigation is not possible
- **Environmentally friendly:** Its use of light precipitation effectively reduces problems of soil erosion and plant damage

| Sprinkler head specifications | Small Micro-Sprinkler System | Large Micro-Sprinkler System | Mini-Sprinkler System (choice of 3 types of sprinkler heads) |
|---|---|---|---|
| Picture |  |  |  Triangle butterfly sprinkler  Circular butterfly sprinkler  Arm sprinkler |
| Nozzle diameter (mm) | 1.2 | 1.2 | 2.2 |
| Pressure head minimum (m) | 8 | 10 | 12 |
| Pressure head maximum (m) | 15 | 15 | 20 |
| Wetting diameter at minimum head (m) | 7 | 7 | 10 |
| Wetting diameter at maximum head (m) | 9 | 8 | 12 |
| Discharge at minimum head (lps) | 0.10 | 0.20 | 0.20 |
| Discharge at maximum head (lps) | 0.15 | 0.28 | 0.30 |
| Number of sprinkler heads per set | 4 | 8 | 12 |
| Avg. irrigation coverage with 3 shifts/day ($m^2$) | 250 | 500 | 240 |
| Spacing between sprinklers (m) | 4 | 4 | 5 |
| Water pressure (m) | 8-15 | 10-15 | 12-20 |
| Average discharge (lps) | 0.12 | 0.25 | 0.25 |
| Price of complete set in NRs (2007)* | 881 | 1655 | 767 |

** Price subject to change due to alterations in the price of raw materials and other input costs.*

## Spare Parts List

If treated well, the system will last 3-4 years without component replacement. However, sometimes system problems do occur that require a spare part purchase.

| System Problems | Spare Part Required | Cost (NRs)* |
|---|---|---|
| Head breakage | Sprinkler head (micro) | 40.00 |
| Tee breakage | Tee | 5.00 |
| Gate valve leakage | Gate Valve | 7.00 |
| Line filter clogging | Clean filter | -- |

** Costs based on the 2007 market price. Prices subject to change due to alterations in the price of raw materials and other input costs.*

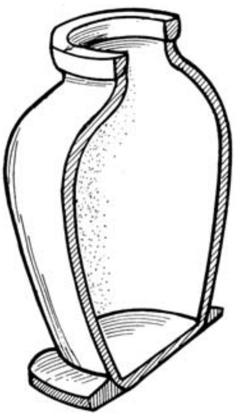
## Cost

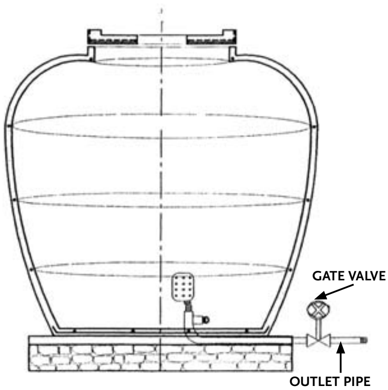
Prices fluctuate according to region and date. Please see the price list at www.ide-international.org/library/techindex.php or call IDE/Nepal at Tel: 01-552-0943 for more information.

Low-Cost Water Storage

# MODIFIED THAI JAR

*Appropriate water storage technology for rural households*






## Tank Components and Cost Estimates

| Component | Unit | Rate (NRs) | 1000 liter MTJ | | 1500 liter MTJ | | 3000 liter MTJ | |
|---|---|---|---|---|---|---|---|---|
| | | | Qty | Total | Qty | Total | Qty | Total |
| **DIRECT CASH COMPONENT** | | | | | | | | |
| Cement | Bag | 500 | 2 | 1000 | 4 | 2000 | 6 | 3000 |
| White cement | Kg | 20 | 2 | 40 | 3 | 60 | 4 | 80 |
| 7 mm steel rod | Kg | 54 | 2 | 108 | 3 | 162 | 5 | 270 |
| 8# Gabion wire | Kg | 61 | 1.5 | 91.5 | 2 | 122 | 4 | 244 |
| Chicken wiremesh | m² | 45 | 1 | 45 | 2 | 90 | 4 | 180 |
| Binding wire | Kg | 55 | 1.5 | 82.5 | 2.5 | 138 | 4 | 220 |
| Pipe fittings | Set | 700 | 1 | 700 | 1 | 700 | 1 | 700 |
| Filter | No. | 150 | 1 | 150 | 1 | 150 | 1 | 150 |
| Plastic sheet | m² | 320 | 0.35 | 112 | 0.55 | 176 | 1 | 320 |
| Mason wage | NRs/ day | 500 | 3 | 1500 | 4 | 2000 | 7 | 3500 |
| Jute bags | No. | 10 | 8 | 80 | 12 | 120 | 18 | 180 |
| Tools | Lump sum | 500 | 1 | 500 | 1 | 500 | 1 | 500 |
| **SUB TOTAL** | | | | **4409** | | **6218** | | **9344** |
| **NON-CASH COMPONENT** | | | | | | | | |
| Stone | ft³ | 22.7 | 2 | 45 | 3 | 68 | 4 | 91 |
| Sand | ft³ | 28.4 | 14 | 397 | 15 | 425 | 20 | 567 |
| Gravel | ft³ | 31.2 | 3 | 94 | 4 | 125 | 6 | 187 |
| Unskilled labour | NRs/ day | 200 | 4 | 800 | 4 | 800 | 9 | 1800 |
| Bamboo, rope, water | Lump sum | 125 | 1 | 125 | 1 | 125 | 1 | 125 |
| **SUB TOTAL** | | | | **1461** | | **1543** | | **2770** |
| **GRAND TOTAL** | | | | **5870** | | **7760** | | **12114** |

Note: Above material rates are based on the 2007 Kathmandu market price. Prices may vary regionally due to transportation costs.

## System features

- Available in three sizes – 1,000; 1,500; 3,000 liter capacity
- Cheaper than commercial plastic and masonry tanks
- Simple to construct in 3-5 days with assistance of local trained mason
- Robust and easy to maintain
- Can be built above ground or partially buried
- It can be used to store water from any source for multiple applications

# MODIFIED THAI JAR

## System Benefits

- **Water Security:** It provides water security to meet all household needs – domestic and productive
- **Use with any source:** It can store harvested rainwater or water piped from other sources, depending on water availability and usage
- **Reduce Drudgery:** It can reduce women's water collection workload
- **Increase Income opportunity:** Use of water for productive purposes can generate income

## Spare Parts

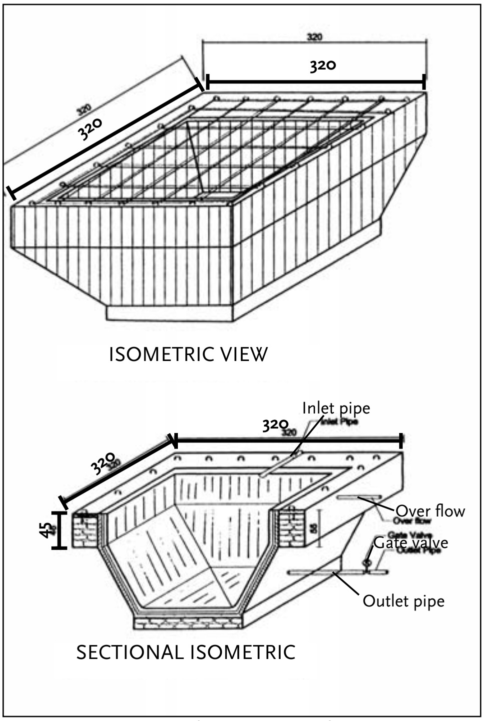
If treated well, the system will last several years without major problems. The only system problem that requires part replacement is gate valve leakage. If the gate valve begins to leak, it must be replaced. The cost range is NRs. 1500-4500 according to size (based on 2007 market prices).

## Cost

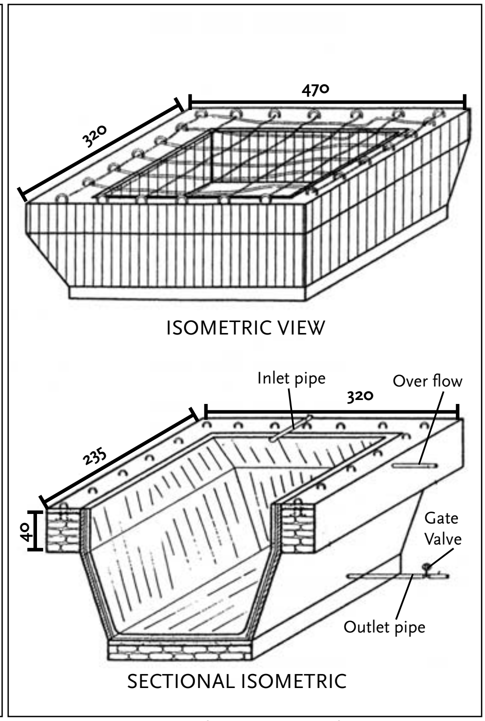
Prices fluctuate according to region and date. Please see the price list at www.ide-international.org/library/techindex.php or call IDE/Nepal at Tel: 01-552-0943 for more information.

# FERRO-CEMENT LINED TANK

*Appropriate water storage technology for rural households*




6000-liter capacity tank




10,000-liter capacity tank

## System features

- Available in two sizes – 6,000 and 10,000 liter capacity
- Cheaper than commercial plastic and masonry tanks
- Simple to construct in 7-10 days with assistance of local trained mason
- Robust and easy to maintain
- It can be used to store water from any source for multiple applications

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## Spare Parts

If treated well, the system will last several years without major problems. The only system problem that requires part replacement is gate valve leakage. If the gate valve begins to leak, it must be replaced. The cost range is NRs. 2500-4500 according to size (based on 2007 market prices).

## Cost

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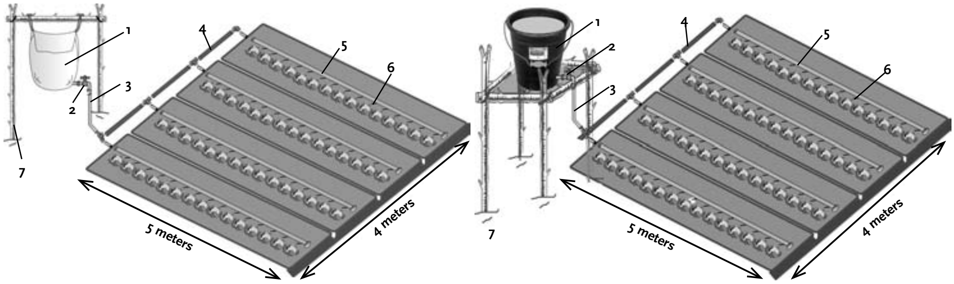
IDEal Micro Irrigation Systems

# IDEal DRIP SYSTEM 20 m² (IDS20)




## Components and specifications

| No. | Component | Size | Description |
|---|---|---|---|
| 1 | Plastic Water Bag or Plastic Bucket | 20 liters | Water storage container |
| 2 | Valve and Filter Assembly | 16 mm | Valve regulates water pressure flow; filter removes particles that can clog the system |
| 3 | Mainline Lay Flat Tubing | 15 mm diameter; 0.2 mm wall thickness | Runs water from the storage container to the submain line |
| 4 | Submain Line Lay Flat Tubing | 15 mm diameter; 0.2 mm wall thickness | Supplies water to the lateral lines |
| 5 | Lateral Line Lay Flat Tubing | 15 mm diameter; 0.2 mm wall thickness | Supplies water to the microtubes |
| 6 | Microtube | 1.2 mm diameter; 25 cm length | Applies water directly to the plant root zone |
| 7 | Bamboo/Wooden Post or Platform | 1 meter height | Used to hang or set storage container at a height of 1 meter |

*Note: The standard design is 1 meter spacing between lateral lines and 40 cm spacing between microtubes for continuous wetting. The design is adjustable.

## System features

- Components manufactured from high quality virgin plastic for strength and durability
- Component material is not harmful to the environment
- Kits are inclusive of all system components
- Row width and in-row spacing is adjustable during set-up to suit your needs
- Installation is quick and simple
- Choice of a plastic bag or bucket for water storage
- For closely spaced rows (less than 50 cm), one lateral line can be used for two rows
- Two kits can be combined at one water source to cover a larger area
- This low-pressure system uses gravity for water pressure

# IDEal DRIP SYSTEM 20 m² (IDS20)

## System benefits compared to traditional irrigation

- **More Crop per Drop:** Less water is required to irrigate the same area
- **Increased Yield:** Higher yields and better product quality can be achieved
- **Labour Savings:** Less labour is required for land preparation, irrigation, weeding, fertigation and crop protection
- **Fertilizer Savings:** Soluble fertilizer can be passed through the drip kit, increasing application efficiency and evenness of distribution
- **Energy Savings:** There is no need to use a pump because the system uses gravity for pressure
- **Terrain Flexibility:** It can be used on slopes where traditional irrigation is not possible

## Spare Parts List

If treated well, the system will last 3-4 years without component replacement. However, sometimes system problems do occur that require a spare part purchase.

| Major Component | Function | Possible Problem / Malfunction | Cost to replace (US$) |
|---|---|---|---|
| Poly Bag 20-liter | Stores water | It may leak | 1.08 |
| Adapter 32 x 16 mm | Connects main pipe to bag | It may break | 0.13 |
| Valve 16 mm (online) | Controls flow of water | It may break | 0.13 |
| Filter 16 mm flat screen | Filters out particulates from water | The screen may wear out | 0.21 |
| Easydrip Tape 15 mm O.D., 200 micron | Used as submain and lateral pipe | It may get cut and leak | 0.028 per meter |
| Tee 16 mm with polytube sleeve 16 mm x 3 cm | Connects lateral pipe to submain pipe | It may break | 0.039 |
| Microtube 25 cm long x 1.2 mm I.D. | Delivers water as per required flow rate | It may get clogged due to dirty water | 0.005 |

## Cost

Prices fluctuate according to region and date. Please see the price list at www.ide-international.org/library/techindex.php or call +91 (253) 2575131 for more information.

## About the Authors

**Monique Mikhail** conducted the research and writing of this book in Nepal and Maharashtra, India as Technical Writer/Research Analyst with IDE (International Development Enterprises) of Denver, Colorado, USA. Concurrently, she synthesized media materials for the first comprehensive cataloging of IDE's appropriate technologies in Nepal and India. She received her Masters of Science from Tufts University, researching point of use water filtration and wheat production in rural Maharashtra. Prior to graduate school she worked as a political advocate in Washington DC on agricultural, food safety, and environmental issues.

**Dr. Robert Yoder** is Technical Director, Water Technology with IDE. He is currently based in Addis Ababa, Ethiopia, managing design and development of water control technologies for smallholder farmers. He was a Senior Associate with the consulting firm Associates in Rural Development of Vermont, USA, and prior to that managed the International Water Management Institute's program in Nepal. His dissertation research investigated farmer-built-and-operated irrigation systems in the hills of Nepal. Dr. Yoder traveled extensively in Nepal and India to design and install micro-hydropower systems while employed by the Development and Consulting Services of Butwal, Nepal.

This book explores the practical implementation of the multiple-use water services (MUS) concept in Nepal and India, focusing on community-level lessons and implications for scaling up the approach. Lessons are drawn from projects that attempted to move beyond the segregation of irrigation and domestic water systems to allow the poor to access water for their domestic needs as well as enable income-generating vegetable production. Water service implementers and researchers will gain knowledge from two unique MUS models: direct NGO implementation of gravity-fed community system design in the middle hills of Nepal, and access through a large-scale government domestic water project in India. The MUS work in both countries included application of the learning alliance approach, allowing idea sharing at various levels (national/state, district, and local). These community, NGO, and government partner efforts to integrate water resource use will inspire professionals to look at village water use and service delivery in new ways.

**This book is jointly published by International Development Enterprises (IDE), the Challenge Program on Water and Food (CPWF), and the International Water Management Institute (IWMI).**

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