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# SOCIO-ECONOMIC FEASIBILITY STUDY OF MAKAIMRO LIFT WATER SUPPLY SCHEME IN TANAHUN DISTRICT OF NEPAL


**Submitted By**

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A Research Report on Feasibility Study of a Lift Water Supply Scheme as a Partial Fulfillment of Masters Degree in Water and Environmental Engineering at Aalto University, Finland

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## ACRONYMS USED IN THIS REPORT

| | |
|---|---|
| DDC | District Development Committee |
| DWIG | District WASH Implementation Guideline |
| EIA | Environmental Impact Assessment |
| ENPHO | Environment and Public Health Organization |
| FGD | Focus Group Discussion |
| GV | Guideline Value |
| HH | Household |
| IDA | International Development Association |
| IEE | Initial Environmental Examination |
| IGA | Income Generation Activities |
| KII | Key Informant Interview |
| lpcd | Litres per capita per day |
| l/s | Litres per second |
| LWSS | Lift Water Supply Scheme |
| MPPW | Ministry of Physical Planning and Works |
| NDWQS | National Drinking Water Quality Standards |
| NEA | Nepal Electricity Authority |
| NEWAH | Nepal Water for Health |
| NMIP/DWSS | National Management Information Section/Department of Water Supply and Severage |
| NPV | Net Present Value |
| O&M | Operation & Maintenance |
| ODF | Open Defecation Free |
| PSU | Project Support Unit, refers in this report to the PSU of RWSSP-WN |
| RWSSP-WN | Rural Water Supply and Sanitation Project in Western Nepal |
| RWH | Rain Water Harvesting |
| SP | Service Provider, which is facilitating to implement the WASH activities in the field in co-operation with the PSU and District |
| SPSS | Statistical Package for Social Sciences |
| VDC | Village Development Committee |
| WASH | Water, Sanitation and Hygiene |
| WHO | World Health Organization |
| WTP | Willingness To Pay, |
| WUSC | Water Users and Sanitation Committee |

## DEFINITIONS

| | |
|---|---|
| Kuwa | Nepali word for water hole, a commonly used water source in rural areas of hilly Nepal |
| HH Survey | The survey conducted to the households due to this research |
| Rs | Rupee, the currency of Nepal (the rate of 11.6.2011 was 104 Rs = 1 €) |
| Scheme | a system to draw water from a suitable source, treat it if needed and supply to consumers |

# EXECUTIVE SUMMARY

Compared to gravity schemes, lift water supply schemes (LWSS) in hilly Nepal are technically challenging and expensive but sometimes the only option to get water supply due to great altitude difference of the source and users. This case study was carried out by a Finnish degree student to find out if Makaimro LWSS in Tanahun district of Western Nepal is socio-economically feasible and replicable. The main tool used was a household survey conducted to 40 of the 265 beneficiary households (15%) during the first days of construction works. This was supported by observations, key informant interviews, focus group discussions, literature and knowledge of specialists.

70% of the households did not experience any problems with the water quality of their present primary source but the average fetching time was 3.5 h/HH/day and the daily quantity of fetched water from sources outside the house was 95 l/HH and 16 l/person indicating low water consumption. Males fetched 1/3 of the trips. Rain water harvesting was to some extent supporting the water situation of 35% of the households but this technology was not sufficient for all purposes or the whole year. The things people were mainly expecting from the scheme were comfort, time saving and the facility of micro irrigation for maintaining kitchen garden. Increased involvement in agriculture, livestock and household work were the favoured ways of using the saved time in future.

The households were asked if they are willing to contribute the proposed amounts of cash and labour days for the scheme construction. 83% agreed with the proposed up-front cash contribution of 1340 Rs/HH whereas the labour contribution of 38 days respective regular water tariff of 200 Rs/month were agreed by 73% each. 63% of the households agreed with all three amounts. Only one household said they can not afford the regular tariff whereas 23% had enough money and the others (75%) were going to increase income or reduce expenditure to meet the fund requirement. The proposed tariff was 1.9% of the average household income. Many villagers believed that increasing saved time and availability of water will significantly help to generate more income. According to the cost estimate, present running costs will be 170 Rs/HH/month which enables to save some money for unexpected expenditures. For instance pump damages due to lightning are a serious and expensive threat to the scheme.

Despite trying to involve all the people in the scheme implementation process, only 63% of the respondents thought they had got enough information about the scheme. The others wanted more information about both technical and economic aspects. 23% were not informed about public hearing, which was held during the final endorsement of scheme design from the community. After not being informed, lack of time was the most common reason not to attend the mass meetings. Many households suggested cluster meetings or cluster messengers as an information channel. It seems like the community is willing to work and pay for the scheme but very much depends on possibility to do income generating activities as well as enhancing the capacity of WUSC to do right technical-economic decisions. The fixed water tariff and the low design providing 30 liters per capita per day might lead to conflicts. In scheme implementation there is need for support in livelihood promotion, involvement of the community and a cost-effective technical design which considers the O&M costs and life cycle.

# ACKNOWLEDGEMENTS

This research has been the outcome of team work and I want to express my sincere gratitude to many directions. On organizational level, Aalto University accepted this research as a part of my studies and gave me a scholarship, Rural Water Supply Project in Western Nepal has been supporting me from the beginning to end and District Development Committee of Tanahun provided the study area and other support to carry out the research.

Among the personnel of RWSSP-WN, special thanks go to my supervisor Mr. Guneshwar Mahato (Water and Sanitation Specialist) for tolerant guidance during all steps of the study. Mr. Markus Tuukkanen (Junior Technical Advisor) and Bimal Sharma (O&M Specialist), are highly acknowledged for their detailed comments which have been invaluable. I have also gained new perspectives from Mrs. Sangita Khadka (Gender, Inclusion and Social Mobilization Specialist), Mr. Chabbi Gaudel (Health and Sanitation Specialist) and Mr. Amrit Rai (HRD and Monitoring and Evaluation Specialist). I am thankful to Mr. Arto Suominen (former Chief Technical Advisor) for giving me this opportunity to do research in Nepal. Thanks to drivers for safe transport to the field.

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## DISCLAIMER

This case study report on “Socio-economic feasibility study of Makaimro Lift Water Supply Scheme in Tanahun district of Nepal” reflects the views of the author. The study has been carried out from the answers given in one community and it may not describe the whole study area or other areas in Nepal.

# 2 INTRODUCTION

The number of electrical lift water supply schemes (LWSS) is increasing in the hilly area of Nepal. They are implemented in places, where the altitude of suitable water sources is very low compared to the altitude of settlement of the beneficiaries and where schemes with gravity and other simple technological options can not be implemented. Compared to other water supply schemes, the construction, operation and maintenance of an electrical water lifting scheme requires much more technical knowledge and money. Therefore the community must have strong willingness and ability to pay for the scheme and manage the challenges of future operation and maintenance (O&M) for its sustainability. This study was carried out to find out if electrical water lifting schemes can be a socio-economically feasible alternative or not.

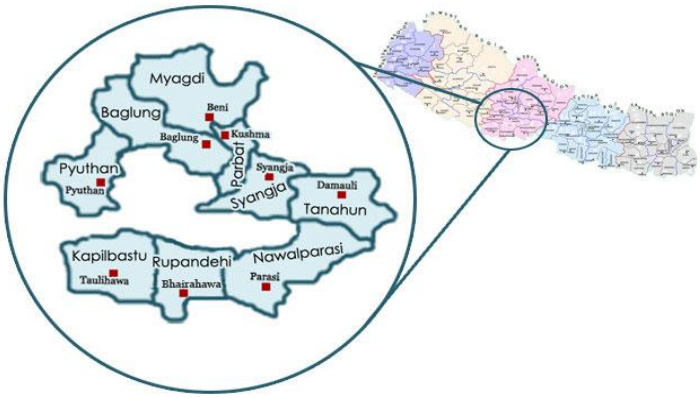
## *2.1 Background*

This case study on "Socio-economic Feasibility Study of Makaimro Lift Water Supply Scheme in Tanahun district of Nepal" is prepared in response to a partial fulfilment of Masters' Degree studies at Aalto University of Finland and for a research work to Rural Water Supply and Sanitation Project in Western Nepal (RWSSP-WN). The research is done by Ms. Laura Aaltonen who is a fifth (final) year student from Aalto University, Finland. She worked as an Intern for the project for 3 months period starting from 26th of March to 1st of July 2011. This study is an individual report for the project and an empirical part of the Master's Thesis of Laura Aaltonen.

Nepal is a country with enormous fresh water potential but also enormous challenges regarding to the actual coverage of water supply and sanitation situation. The reasons are not only geographical but also political, traditional and financial. In Nepal, 80% of the population has access to water supply through improved systems. In the development region of Western Nepal where RWSSP-WN is working, the coverage from such systems is on average 85% which means 4.6 million beneficiaries. As only 18% of the schemes in Nepal are well managed with no need for reparation, these coverage figures do not reflect the reality. Therefore, sustainability of the schemes is a major concern. (NMIP/DWSS, 2010)

Water lifting systems are a seldom way of getting the water: they fall into the category of other managed systems which only covers 3.3% of the water supply system scenarios in Nepal. The main problem with water lifting schemes is the massive investment cost as well as the availability and cost of electricity including other operating expenses, which are comparatively high and in many of the cases beyond the affordability of the community. Only 0.8% of the total numbers of 38,307 Pipe Water Supply schemes in Nepal are using pumping systems whereas 99% are run by gravity. (NMIP/DWSS, 2010).

In Western Nepal, there are still many villages up on the hills without water supply on the spot. The water sources are either far away, located at lower elevation than the settlement, are of poor quality or have inadequate supply. In such situations, electrical lifting might be a solution to consider. Currently, about twenty communities are in the process of getting electrical water lifting schemes supported by RWSSP-WN. One of the schemes, Makaimro lift water supply scheme in Thaprek VDC in Tanahun District, was selected as a research object after visiting two schemes. Makaimro was selected because the design establishment was further, the accessibility from Pokhara was best, and there were good experiences of co-operation with the service provider working in the VDC.




**Picture 1. The project area of RWSSP-WN (Source: www.rwssp-wn.org).**

Rural Water Supply and Sanitation Project in Western Nepal (RWSSP-WN) is a rural water supply, sanitation and hygiene sector support program mainly funded by the Government of Nepal (23%) and Government of Finland (67%). RWSSP-WN takes part in supporting the aim of the Government of Nepal to provide all its citizens the basic level of water supply and sanitation services by the year 2017 (NMIP/DWSS, 2010). Better water supply, sanitation and hygiene conditions have a direct impact on the health and economic wellbeing of the people. The working area of RWSSP-WN consists of nine districts that can be seen in Picture 1.

To achieve the commitment of the beneficiaries and economic sustainability, the program has adopted norms that follow the National Rural Water Supply and Sanitation Policy (MPPW, 2004). The planned water supply schemes must meet for instance the following economic criteria:

- The community must contribute in investments with a minimum of 20% of cash or kind of which at least 1% must be in cash
- The community must cover all of the operation & maintenance cost and an O&M fund must be established

The Local Self Governance Act, 1999 (Law Management Society, 1999) has given the responsibility of implementation, operation and management of water supply schemes to the community. The Water Resources Strategy of the Government of Nepal (WECS, 2002) aims to increase access to electrification in rural areas and to strengthen implementation capacity for new rural water supply and sanitation schemes. Therefore it is reasoned to construct this kind of lifting schemes.

According to the Environmental Protection Act (MPE, 1997), small water supply schemes for a population of 5000 to 50,000 are required to conduct Initial

Environmental Examination (IEE) and the bigger ones Environmental Impact Assessment (EIA). With a population of 1685, Makaimro lift water supply scheme is below both of these limits. The biggest environmental risks are related to the way of using saved time and increased availability of water. They are difficult to predict. Therefore the environmental examination was decided to be transformed to general technical feasibility of the scheme with parts of source protection and transmission line stability, as those are the most crucial environmental short-term risk caused by the scheme and have direct impact on the socio-economic feasibility.

## *2.2 Justification of research*

As most of the simple gravity flow water supply schemes are already covered, the remaining schemes to be implemented are comparatively critical, difficult and expensive. Lifting schemes are a system with much future potentiality in Nepal but there has not been much research on them. The benefits of a water lifting scheme are obvious: comfort, more time to do something else and better water quality. Especially the women and children are likely to be benefited because they are the ones who usually fetch most water and might also be physically attacked while carrying out the water trips. Therefore the lifting scheme will increase the gender equality and provide new opportunities for the women as well as time for children to attend school. Nevertheless, the scheme has big costs to the community. Before the scheme is finished, the community needs to contribute in the capital cost of the scheme, pay up-front cash for the O&M fund and contribute in construction works. After the scheme is finished, the community needs to raise a comparatively high monthly fee in cash to operate and maintain the system. It can not be taken granted that the beneficiaries can and want to afford the operation and maintenance in a sustainable way - by themselves. The economy must be run by WUSC (Water Users and Sanitation Committee) which consists of normal community members who are not professionals in water management. In this study, the household level views were studied deeply and the WUSC level views briefly.

The main problem statement can be expressed as follows: is a water lifting scheme a socio-economically feasible and sustainable water supply alternative in the hilly areas of Nepal or not. This study aimed to reveal the villagers' actual needs, problems and abilities concerning using, fetching and paying for the water. This was clarified in this research using field work methods and previous experiences from literature and experience of specialists working for RWSSP-WN. The results of this study can be partly or fully replicated in water lifting scheme planning all over the country as long as the technical, environmental and socio-economic details are assumed to be similar enough.

## *2.3 Objectives of the study*

The overall objective of the study was to understand if and when lifting schemes in the hills can be economically and socially sustainable. In addition, the technical feasibility of source and scheme was studied briefly. The specific sub-objectives of the study are described below. They are divided into segments of social feasibility, economic feasibility and technical feasibility.

### 2.3.1 Social feasibility

Specifically, under the social feasibility, following major social factors were studied:

- Willingness to contribute to the cost and construction of the scheme;
- Willingness to contribute to the operation and maintenance of the scheme;
- Possibility and household opinions of cross-subsidization to poor households;
- Institutional management and functioning of the Water Users and Sanitation Committee;
- Present water management practice (fetching time, consumption, hardship)
- The estimated social impacts of the increase of water quantity and quality as well as time saving in the community;
- Social acceptance of proposed source;
- Present use of proposed source and possibility of conflicts and
- The understanding of the community about the advantages and disadvantages of the scheme.

### 2.3.2 Economic feasibility

Concerning the economic feasibility, the following areas were mainly examined:

- Investment costs in total;
- Per capita cost;
- Estimated O&M costs;
- Required HH level labour contribution (days/HH);
- Required HH level cash contribution for investments and up-front operation and maintenance costs (O&M);
- Household level contribution to regular O&M costs;
- Affordability of the regular O&M costs as % of average HH income and
- Benefit-cost analysis (BC).

### 2.3.3 Technical feasibility

Under the technical feasibility, following matters were studied:

- Source environment (landslide risk, vandalism risk);
- Transmission pipeline alignment (landslide risk);
- Water quantity and quality as well as possibility of contamination and
- Other technical risks (breakdown of pumps, availability of electricity, professionalism of operators).

## *2.4 Limitations of the study*

The major limitations of the study are presented as below:

- The environmental feasibility and impacts were not examined in detail;
- The baseline information covered only 229 households out of total 265 beneficiary households;
- The ultra poor households among the beneficiaries could not be identified;
- There is no information of the post construction phase and actualization of willingness as this study was done during the construction works;
- The economic benefit-cost analysis was indicative but simplified;
- The irregular maintenance costs were not estimated, and
- Water quality was not tested in laboratory but tested using a field testing kit, which is not sufficient for testing all parameters, especially biological contamination.

# 3 APPROACH & METHODOLOGY

Field work was the main tool used to gather primary level information for this case study. The primary information-giving method was a household survey conducted in 40 sample households out of 265 households (15.1%). Other supporting field work methods were six key informant interviews, two focus group discussions with women and an observation walk to the source which was carried out to gather technical information. In this way also Participatory Rural Appraisal (PRA) was used for this study. The field work started on the same day with the construction works and lasted for 12 days. Apart from information collected on the field, secondary information was collected from supportive literatures gathered from the PSU, district and VDC as well as from internet. In addition, the specialists of RWSSP-WN observed the construction works and institutional management of WUSC and provided other valuable information as well as helped during the reporting. The water quality was tested by the service provider using an ENPHO field test kit provided by district. This chapter describes the research process and the success of sampling. The detailed schedule of the household survey, other field work activities and the whole research process is represented in annex 1.

## *3.1 Literature Review*

Supportive literature included various relevant Nepalese policies, strategies and reports as well as international publications. Some information of the beneficiaries was taken from the baseline survey carried out in 2010 as a part of VDC WASH planning activities. The technical and economic details of the project were mainly provided by the district. Some theoretical background about willingness-to-pay methods is represented in this section because estimating the WTP was one of the main objectives of this study. Other used literature is within the text when relevant. The details of the literatures reviewed are presented at the end of the report as references.

According to “Good Practices for Estimating Reliable Willingness-to-Pay Values in the Water Supply and Sanitation Sector” published by ADB (Guntilake et al, 2006), one way to find out the willingness is to ask an open ended question where the respondent states the maximum amount she or he is willing to pay: “How much is your household willing to pay for…?”. Closed-ended questions (also referred to as “dichotomous choice”) ask if the respondent is willing to pay a specified amount as the value of the improved service or not: “Are you willing to pay…?”. Based on the answer (yes/no), the bid will be increased or decreased to a predefined value before repeating the process and getting closer to the willingness until the value is found. Deciding the starting value is critical. According to the source, open-ended questions provide more information than closed-ended because the mean arithmetic WTP values can be estimated by simple arithmetic. However, the respondents are usually not accustomed to such tasks in their daily life decision making and it can be difficult to measure the willingness even when having good information about benefits and costs.

In the HH survey of this study, the willingness to pay for improved water supply was asked in many stages. First, the very general question “Are you willing to pay something for improved water supply?” was asked. Secondly, the households were asked how

much they are willing to pay in different categories (up-front cash, labour contribution, regular water tariff) using open-ended questions. After some questions on scheme knowledge, the willingness was tested again but this time with the actual designed contribution numbers of 1340 Rs for up-front cash, 38 days for labour contribution and 200 Rs as regular water tariff. That is the first stage of the method of using closed-ended questions. If the households did not agree the bid, they were asked what they want to pay. The households were given more explanation about the use of the money or tasks during the labour days. Later in the survey, the households were asked the question "How are you going to cover the monthly tariff?" and given options.

## *3.2 Preparation Work*

The author of this report visited public hearings of two lifting schemes: Alamdevi LWSS in Syangja district and Makaimro LWSS in Tanahun. Makaimro LWSS was selected as research object because the design establishment was further, the accessibility from Pokhara was best and there were good experiences of co-operation with the service provider there. The HH survey and other data collection formats and research proposal were prepared with the help of PSU specialists. DDC Tanahun was visited and the HH survey was pre-tested in one household in Ghansikuwa VDC of Tanahun district where the people are waiting for a gravity scheme to be implemented with the support from RWSSP-WN. The field testing was found useful and based on the lessons learned the initial questions were modified considerably.

## *3.3 Field Work*

### 3.3.1 Conduction of the household survey

A household questionnaire was prepared to use it as the main tool to gather information for this study. The questions were about present water use and fetching, estimated use of saved time, willingness to contribute, participation in scheme planning for the time being as well as knowledge and opinions about the scheme. The aim was to find out the present water management practice, opinions, knowledge and understanding of the scheme as well as willingness to pay and contribute during and after the implementation phase.

The survey was conducted during eight days in April-May 2011 to 40 sample households out of the total number of 265 beneficiary households in the scheme area (15.1%). The population of these households was 294 (17.4% of the present population 1685). The field work team consisted of the author and of the health promoter of the service provider. The health promoter had been working in the area since one year, gained the trust of the people and done household surveys before also. The health promoter asked the questions using the Nepali version of the questionnaire and translated the answers to the author who wrote them down in the English version. The Nepali version was found out to be "high Nepali" and not easy to understand for the locals. Therefore, the interviewer had to modify some word formats which might have created a bias. A good indicator about equal practices in all households is that the exactly same persons conducted all surveys.

One of the household members was the actual interviewee but also others were allowed to discuss and contribute. This was done because water issues affect the whole family. It is for instance possible that the children fetch the water, the mother uses it in the kitchen and the father decides about use of money. In 50% of the households the interviewee was the household owner whereas 30% of the interviewees were wives of the HH owner, 13% sons and 8% others. 58% were male and 42% female. Two to seven interviews (in average 5 interviews) were conducted every day and all except the three first ones were saved on a recorder. The exact schedule of the household survey and other field work activities is represented in the reference part of this report.

### 3.3.2 Sampling of the household survey

The households were selected using stratified sampling. This means that the households were not chosen randomly but tried to make a sample which would represent the real diversion of some differences between the households and make sure that the subgroups are represented equally (Castillo, 2009). These strata used were cluster, ethnicity and income group. The data was taken from the draft tap stand group list and from baseline survey done in all households of Thaprek in 2010 as an orientating part of the VDC WASH planning activities. However, after making different strata, the required numbers of sample households were taken randomly from each strata. The information of some households was missing and not all beneficiary households matched with the names in the baseline survey data. One reason was that the policy of writing the name of the household owner to identify the household had not been followed throughout. However, the baseline survey data was helpful as a guideline and during the field work the stratified sampling could be done more exact with help of the tap stand group list and the knowledge of the staff of service provider and local people. The final cluster distribution of the beneficiary households is represented in Table 1. The ideal sample in the table is the theoretical optimum representation of the cluster among the 40 interviewed sample houses. The table shows that the regional distribution of the sample is representative.

**Table 1. Cluster diversion of all versus sampled households *(Tap stand group list 2011, HH Survey 2011).***

| Ward | Cluster | HHs | % of all HHs | Ideal sample | Final sample |
|---|---|---|---|---|---|
| 5 | Amleswara | 5 | 1.9 | 0.8 | 1 |
| 5 | Arushwara | 10 | 3.8 | 1.5 | 1 |
| 5 | Gairathok | 23 | 8.7 | 3.5 | 3 |
| 5 | Kathipipal | 25 | 9.4 | 3.8 | 4 |
| 5 | Lakuribot | 14 | 5.3 | 2.1 | 2 |
| 5 | Pokarithok | 11 | 4.2 | 1.7 | 2 |
| 6 | Amleswara | 5 | 1.9 | 0.8 | 1 |
| 7 | Aarubot | 24 | 9.1 | 3.6 | 4 |
| 7 | Danda Tol | 21 | 7.9 | 3.2 | 3 |
| 7 | Gahira Tol | 27 | 10.2 | 4.1 | 4 |
| 8 | Chiti Swara | 16 | 6.0 | 2.4 | 2 |
| 8 | Miya Gaun | 47 | 17.7 | 7.1 | 7 |
| 8 | Thati Bazar | 17 | 6.4 | 2.6 | 3 |
| 9 | Oltbandi Tumetol | 11 | 4.2 | 1.7 | 1 |
| 9 | Oltbandi Lamatol | 7 | 2.6 | 1.1 | 1 |
| 9 | Ghaletol | 2 | 0.8 | 0.3 | 1 |
|  | Total | 265 | 100.0 | 40 | 40 |

Table 2 presents the rough ethnicity diversion of all versus sampled households. Brahmin-Chettris have highest position in the traditional Nepali caste system whereas Adibasi-Janjatis are in the middle and Dalits have been the lowest, poorest and most discriminated. Officially, all kind of caste discrimination is nowadays banned in Nepal but the ethnicity was taken as a criterion to get a socially representative sample. The project area is dominated by Adibasi-Janjatis with 48%, most of whom are Gurung. The sampling of Dalits and Muslims was successful whereas Brahmin-Chettris are slightly underrepresented and Adibasi-Janjatis overrepresented.

**Table 2. Ethnicity diversion of all versus sampled households.**

| Ethnicity | HHs | % of all HHs | Ideal sample | Real sample |
|---|---|---|---|---|
| Dalit | 35 | 13.2 | 5.3 | 5 |
| Adibasi-Janjati | 127 | 47.9 | 19.2 | 21 |
| Brahmin-Chettri | 44 | 16.6 | 6.6 | 5 |
| Muslim | 59 | 22.3 | 8.9 | 9 |
| Total | 265 | 100.0 | 40 | 40 |

*Sources: Tap stand group list 2011, HH survey 2011*

The income information for sampling was taken from the baseline survey. Some beneficiary households were not on the baseline survey database or could not be identified from there but the income of 229 out of total 265 households are compared with the income of sampled households in Table 3 and found out to be representative. However, because of different kind of way to ask about the income, the values can not be compared directly but taken as a reference. In the baseline survey from 2010 the income was asked detailed in separate categories whereas the income for this study was asked as one number even though the respondents were helped with summing the different incomes which came to their mind and encouraged to say more. According to locals, some people want to hide a part of their income in this kind of interviews. When comparing the income information of 2010 to the answers on the field, many households reported significantly lower but also bigger numbers. The income aspects are discussed more detailed in chapter 4.3.4 (Affordability to pay).

**Table 3. Comparison of the income between Baseline Survey and Sample HH Survey.**

| Indicator | Baseline survey HHs (N=229) | Sample HHs (N=40) |
|---|---|---|
| Low (<5000 Rs/month) | 22.7% | 22.5% |
| Middle (5000-15000 Rs/month) | 48.9% | 55.0% |
| High (>15000 Rs/month) | 28.4% | 22.5% |
| Average (Rs/month) | 13331 | 10710 |
| Median (Rs/month) | 10167 | 10000 |

*Sources: Baseline survey 2010, HH survey 2011*

### 3.3.3 Key Informant Interviews

The key informant interviews were carried out to find out what is the ability and willingness of WUSC and political leaders to meet the present and future challenges of the scheme. Key informant interview is a method to interview community members who are especially knowledgeable about the topic. Key informant interviews might reveal both common themes and differences between the opinions and experiences. When reporting, the key informant comments should be kept anonymous and not be referred with personal attribution. (Marlow & Sherry, 1999)

Six key informant interviews were conducted. Three of them were group interviews whereas three were individual. The persons to be interviewed were 10 teachers, five members of Makaimro Water Users and Sanitation Committee (WUSC) and three political leaders from the main parties of Thaprek. These three parties were Nepali Congress, Unified Communist Party of Nepal (Maoist) and The Communist Party of Nepal (Unified Marxist-Leninist). The WUSC members were the president, vice-president, secretary, treasurer and one ordinary member.

With the exception of teacher's interview, the interviews with other key informants were recorded and the time of the interview was after the completion of the HH survey. Therefore the prepared questions were partly deleted and replaced by new questions to answer and clarify the main problems and challenges which came up during the HH survey. The author chose the questions and the staff of service provider translated the questions and answers. After a couple of interviews, the key informants were found out to have very homogenous answers and therefore some questions were further modified also to get new information. Even though both the WUSC members and political leaders have much power and knowledge regarding the proposed scheme and community, the answers must be considered as opinions and local voice from the community neither than promises or exact facts.

### 3.3.4 Focus Group Discussions (FGD)

The original hypothesis was that mainly women are responsible of water fetching in the study area. Even if the HH survey indicated that women fetch more water than men and men are the ones who usually go to scheme meetings, also a notable part of men fetched water, knew the sources and had strong willingness to get water supply. Therefore the Focus Group Discussions (FGDs) with women were not as essential as originally thought. However, two brief FGDs were conducted. One was held with 25 women from ward no 7 and another with 5 women from ward no 5.

### 3.3.5 Observation walk

An observation walk to the source was conducted by the author and three employees of the service provider to observe and discuss the source and the construction works which had started recently. Two specialists of the PSU unit visited the WUSC five weeks after the beginning of the construction works to see the progress of the construction works and make an interview about the institutional status of WUSC as a part of their usual monitoring activities. The findings of that visit were also benefited in this study report.

## *3.4 Data Analysis and Reporting*

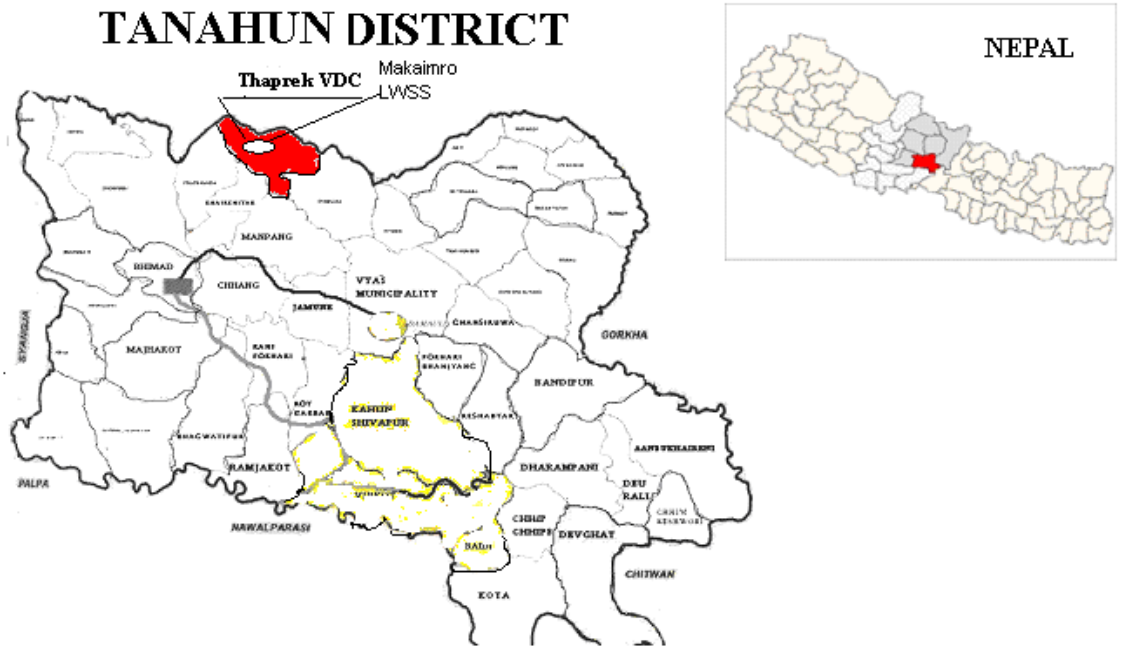
The statistical analysis of the household survey was done using SPSS11.5, a commonly used computer program for analyzing quantitative data. SPSS can create many kind of statistical analysis like cross tabulations, bivariate correlations and variance analysis. Microsoft Excel was used to create charts and tables because of better graphical properties. One aim was to describe and present the survey results. Another and more challenging aim was to find some correlations and causalities between the answers and therefore find out possible solutions how to increase the willingness to contribute. Time and the small sample size of 40 households limited statistical testing and reliability of the tests but some cross-tabulations were done to show the differences between groups. Some $\chi^2$ independency tests were carried out to find out if the difference between the answers of different groups was statistically significant. Some charts, tables and pictures are used to make the presentation more clear and visible.

Chapter 1 is an introduction to the study with parts of background, justification of research as well as objectives and limitations of the study. Chapter 2 presents the methodology used and describes the activities carried out for the study. Scheme area, design and economy are described in chapter 2. Chapter 4 aims to analyze the results and discuss the feasibility from different viewpoints. Chapter 5 summarizes the findings as well as gives the overall impression and forecast. Recommendations about scheme implementation in general and electrical lift water supply schemes and the selected study object in particular are given in chapter 6. The details of analysis work are given in the annexes. The supervisor and other specialists of the PSU gave various comments and suggestions on the report before its final presentation and submission.

# 4 STUDY AREA AND SCHEME

## *4.1 Thaprek VDC*

Makaimro LWSS is located in Thaprek VDC. Thaprek Village Development Committee (VDC) is situated in the northern part of Tanahun District (Picture 2) which is one of the 75 districts in Nepal and located in Gandaki zone of Western Nepal. The average altitude is 1200 m above sea level and the average annual rainfall is 1500 mm. The climate is sub-tropical with an average annual minimum temperature of 2 degree Celsius and maximum temperature of 30 degree Celsius. Thaprek is divided to nine wards and the wards are further sub-divided to 81 clusters. The total population of Thaprek VDC is 4620 and the total number of households is 794. (VDC Thaprek, 2010)




**Picture 2. Location of Thaprek VDC (Source: P.U.R.D., 2011).**

According to a key informant, the first primary school is in Thaprek since 1960, secondary school since 1983, road since 2000 and electricity since 2010. Thaprek was declared Open Defecation Free VDC in the year 2010 just after the WASH activities started with support from RWSSP-WN. A gravity scheme implementation and two source improvements are ongoing in wards 1 and 2 whereas Makaimro lift water supply scheme will cover all households of ward number 7 and a part of the households in wards 5, 6, 8 and 9. For the time being there is no piped water supply system on the project area and the people are fetching water from local sources like kuwa which are located at far distance from the community. NEWAH has promoted rain water harvesting systems on the area but not all households have been covered.

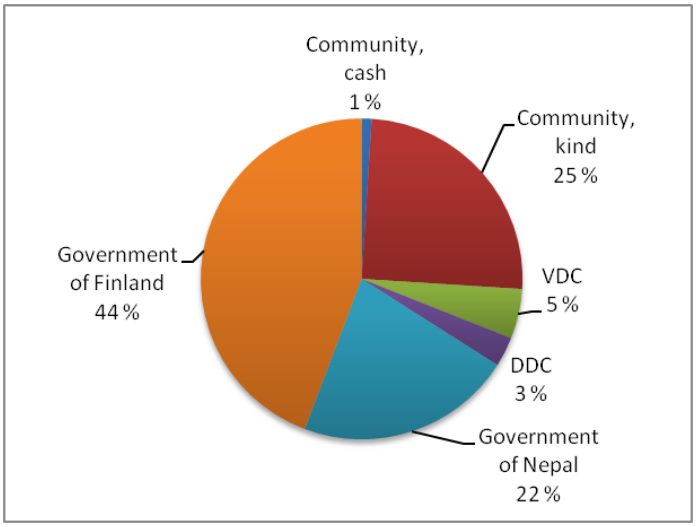
## 4.2 Scheme design and beneficiaries

The water of two proposed springs (Makaimro and Dharapani) with a combined yield of 1.2 liters per second (l/s) will be collected to a collection tank (24 $m^3$) and lifted electrically to an intermediate tank (8$m^3$) situated 200 m above. From there it will be further lifted 170 m to the distribution chamber which is located in Thaprek-7 on a hill top called Deuthan. From there the water will be distributed by gravity system to four reservoir tanks at different locations around the project area each serving specific clusters. At the tanks the water will be disinfected using chlorine before distribution to 41 public tap stands located near the households (average 6.5 HHs/tap). The number of beneficiary households in the scheme design is 265 and the population is 1685 which is 36.5% of whole population of Thaprek VDC. The scheme is designed to meet the water demand of 30 liters per capita per day at the end of the design period of 20 years (2032 AD) using a population growth rate of 1.62% which is an official estimate of the growth in the whole district. Social composition and economic details of the beneficiaries are given in chapter (sub-section 2.3.3: Sampling of the household survey). (P.U.R.D. 2011)

The scheme is designed to have pumping hours of 12 per day and pumping capacity of 7.5 kW per pump station. Both pump stations will be equipped with two pumps which will operate alternately. In the design there is no plan for source protection, no geotechnical survey and no estimate of O&M costs. More technical details of the scheme are given and discussed in chapter 4 (sub-section 4.5: Technical feasibility).

## 4.3 Scheme costs

The estimated total investment cost of the scheme is 11.8 million rupees (DDC, 2011) which will be divided between the community (26%), Government of Finland (44%), Government of Nepal (22%), Tanahun District Development Committee (3%) and Thaprek Village Development Committee (5%). The contribution between the stakeholders is shown in Picture 3 and the more detailed cost estimate in annex 2. All other contributions are in cash but the community contribution is divided into cash and kind according to the National Rural Water Supply and Sanitation Policy (MPPW, 2004), which requires a minimum contribution of 20% from the community including at least 1% cash. This contribution should be divided evenly between the 265 households. In




**Picture 3. Contribution of the different stakeholders to the total scheme cost of 11 827 309 Rs (DDC Tanahun, 2011).**

Makaimro LWSS design the community cash contribution is 1% and the kind contribution is as high as 25%. This kind can include collection of local materials and different kind of labour contribution during scheme construction. In the household survey, the community was asked about the kind contribution in labour days converting all 25% of the estimated scheme cost to labour days valued at the rate of 300 Rs/day.

According to the policy, the community should take full responsibility of future operation and maintenance and repair costs. Therefore it was decided in the agreement that the households are required to raise 2% of the total scheme cost as up-front O&M contribution. Another and more regular way to cover the future operation and maintenance of the scheme is by raising the monthly water tariff of 200 Rs per household per month which will be started to collect after completion of the scheme. The tariff has been decided by WUSC and can be increased or decreased in the future. According to the policy, the collected tariff should be sufficient to cover the operation and maintenance costs of the scheme.

As the design population of Makaimro LWSS is 1685, the per capita cost is 7019 Rs. It falls under the project rule limit of 7500 Rs per capita for lift water supply schemes (Tanahun DWIG, 2009) **Error! Reference source not found.** presents the investment osts in Nepali Rupees and Euros. To estimate the value of the grants for the community, a loan estimate is done. If the community had taken loan to cover the investment costs they do not have to pay (74% of total), with an interest rate of 15.0%, fixed monthly payback tariff and a loan period of 30 years, every household should pay 418 Rs per month which is more than double of the proposed regular water tariff. With a loan period of 20 years the tariff would be 435 Rs/month, with 15 years 462 Rs/month and with 10 years 522 Rs/month.

**Table 4. Investment cost in total and per capita.**

| Total investment costs | Total | Per capita (N=1685) |
|---|---|---|
| Total investment cost (Rs) | 11827309.0 | 7019.2 |
| Total investment cost (€) | 114108.1 | 67.7 |

*Source: DDC Tanahun, 2011*

All required contributions from the household side are presented in Table 5. In practice, WUSC has been collecting up-front cash of 1 400 Rs per household which might alternatively end up in a bigger O&M fund or cross-subsidize the households not paying the money. The final need of labour days per household can never be estimated exactly in the design. The practice is to distribute them equally between the households if possible.

**Table 5. Breakdown of community contribution.**

| Community contribution | Total | Per household (N=265) | Per capita (N=1685) |
|---|---|---|---|
| Cash for investments (Rs) | 118273.1 | 446.3 | 70.2 |
| Cash for the O&M fund (Rs) | 236546.2 | 892.6 | 140.4 |
| Labour (days) | 9856.1 | 37.2 | 5.8 |
| Water tariff per month (Rs) | 53000.0 | 200.0 | 31.5 |

*Source: DDC Tanahun, 2011*

The WUSC, which consists of 11 executive members from the beneficiaries and is making the decisions of the scheme during and after the implementation, has proposed

a monthly water tariff of 200 Rs/HH and hired a staff team comprising of three maintenance workers and two pump operators. The raised O&M cost will be used for electricity charge, salaries of the maintenance workers and pump operators as well as savings for future O&M needs. An estimate and breakwon of O&M costs is presented in chapter 4.3.1. The members of WUSC will work as volunteers for the scheme operation and management.

# 5 FINDINGS AND DISCUSSION

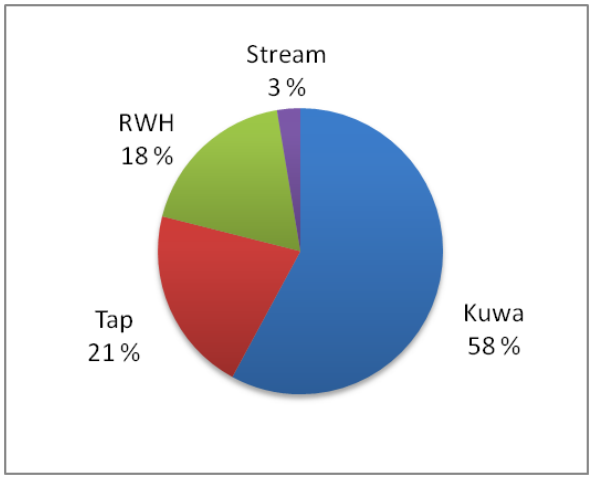
The findings presented in this chapter are mainly based on the household survey which is attached as annex 3. The findings are not only presented but also discussed in this chapter. Many percentages have been rounded up to whole numbers.

## *5.1 Existing Water Management Practice*

### 5.1.1 Used Sources

The households of the study area do not have improved water supply and are therefore fetching untreated water from natural sources and in some cases also harvesting rainwater from their roof. The households were asked about their water fetching and use of two main sources: primary and secondary. As previously found out in a study of rainwater harvesting (RWH) in hilly Nepal (Dahal et al, 2010), most households (77%) do not use rainwater for drinking and cooking purpose. This could be verified in the study area, where only 7% of the households which harvested rainwater were utilizing it sometimes for drinking and cooking. Therefore, also these households which had big concrete tanks for RWH were fetching additional water from other sources during the whole year. To somehow cover all fetching time but only ask about two sources, the RWH households were assumed to fetch water from the same additional source during the whole year. In most cases this was exact.

In this report the main drinking water source of the RWH households is described as primary to make a more homogenous group with other primary drinking water sources. All in all, 14 households used RWH as one of their sources and kuwa or tap as the other source. 22 households used two other sources (kuwa, tap, stream) and four households used one source only. All RWH households used another source also. Some households used more than two sources but they were interviewed about only two. This makes a total number of 76 water sources of four different types (Picture 4). Kuwa was the most common with 58%, followed by tap (21%), RWH (18%) and stream (3%).




**Picture 4. Source types (HH Survey 2011, N=76).**

Kuwa is a natural water hole protected with stones or concrete from landslides and storm water. The taps on the scheme area were reservoir tanks which collect /serve untreated water to the consumers. Picture 5 represents a kuwa and a tap in Thaprek 7 (Cluese pani). This tap is mainly used for bathing and washing laundry.

**Picture 5. Kuwa and tap of Cluese pani in Thaprek-7 (photo: Laura Aaltonen).**

### 5.1.2 Availability and Reliability

Availability of rain water in the tanks was reported to be between 3 and 12 months with an average of 8 (Table 6). All households used the rainwater during the whole period it was available. The availability of primary source averaged in 9.0 months and the period of use was slightly smaller (8.8 months). All secondary sources were available during the whole year but used for only half year. All households said that the sources were available for 24 hours.

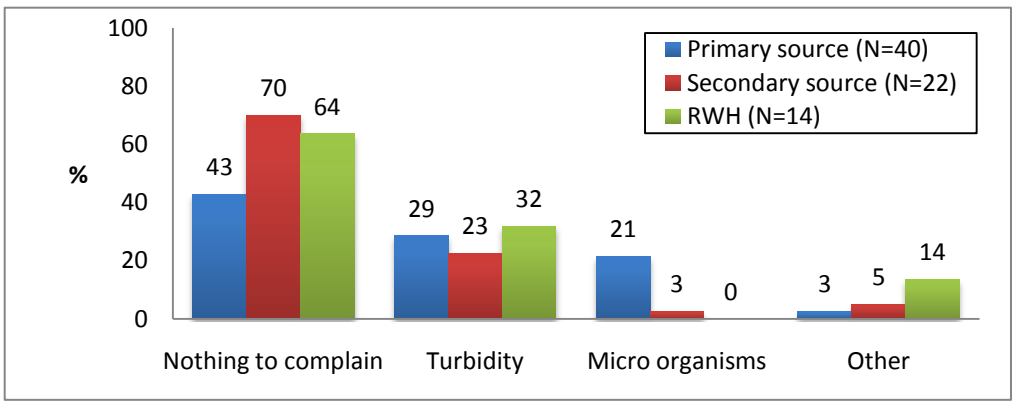
**Table 6. Source availability and use in months.**

| Source of Water | Availability, average | Availability, range | Use, average | Use, range |
|---|---|---|---|---|
| RWH (N=14) | 7.9 | 3-12 | 7.9 | 3-12 |
| Primary source (N=40) | 9.0 | 3-12 | 8.8 | 3-12 |
| Secondary source (N=22) | 12.0 | 12 | 5.9 | 2-9 |

**Source: HH Survey, 2011**

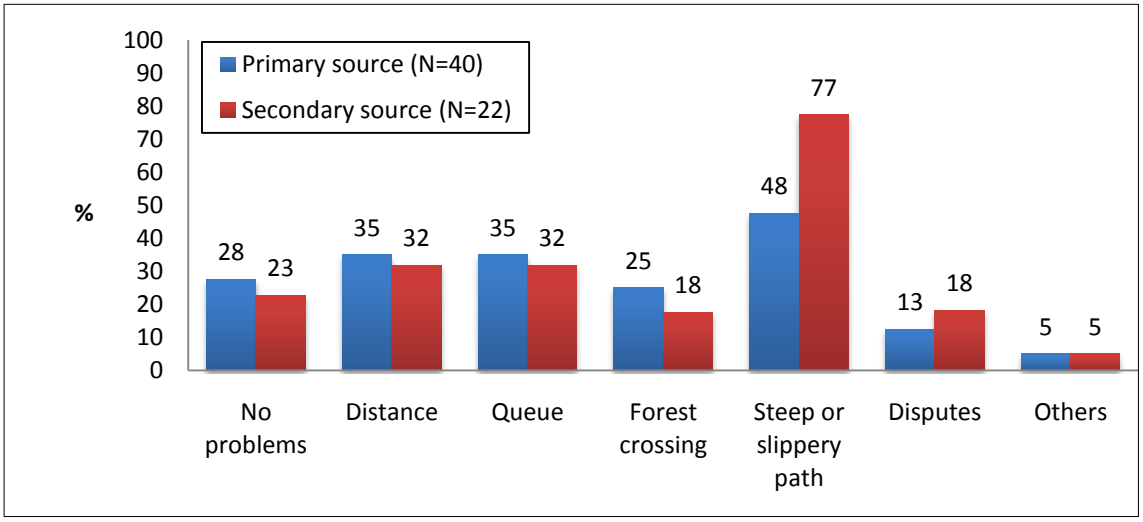
### 5.1.3 Quality and Accessibility

70% of the primary source users said that the water has good quality with nothing to complain (**Error! Reference source not found.**). Secondary sources had a slightly lower atisfaction percent of 64 whereas rainwater quality was considered good only by 43%. Turbidity numbers were quite similar in the range from primary source's 23% to secondary source's 32% whereas micro organism contamination was biggest (21%) in RWH. The other quality problems were temperature, rain water mixed with drinking water and source contamination because of other users. All numbers are subjective opinions of the users and not measured or verified by anyone.




**Picture 6. Water quality problems observed by users (HH Survey 2011).**

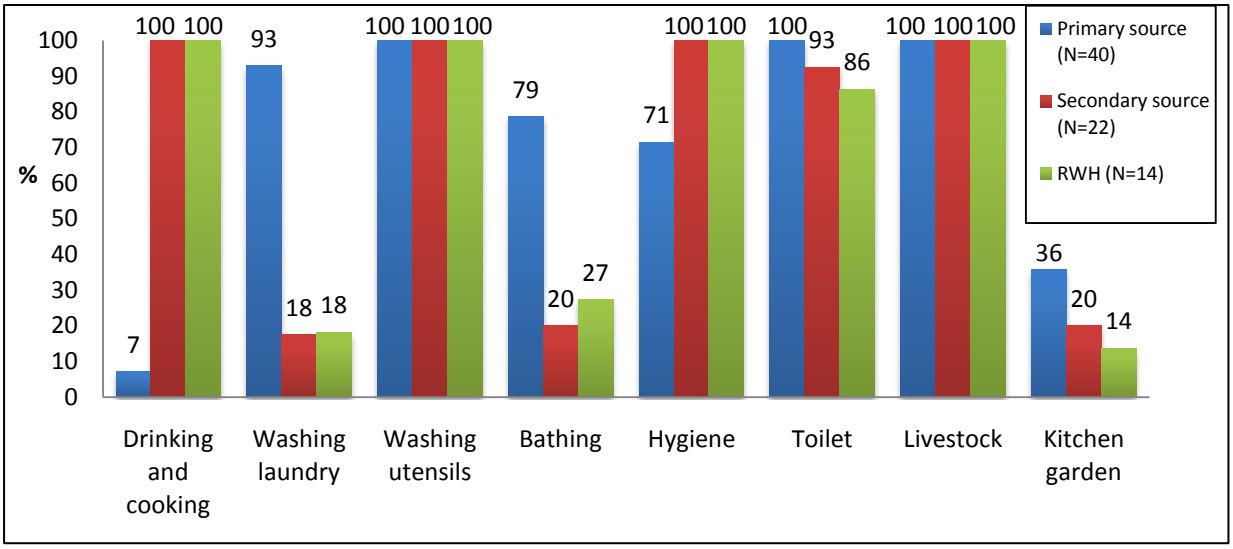
Source accessibility can be considered poor, as only 28% of the primary sources and 23% of the secondary sources got the evaluation of no problems (**Error! Reference ource not found.**). Steep or slippery path was the most common problem on both primary and secondary sources followed by distance and queue demanding higher collection time. The dispute percentage was higher on the secondary sources (18% compared to 13%), which might be explained by more notable water scarcity during dry season or by being irritated because of the long walking distance.




**Picture 7. Accessibility problems of the sources in percentage (HH Survey 2011).**

### 5.1.4 Water use purposes

There were significant water use purpose differences between rainwater harvesting and the other sources. First of all, only 7% of the households used rainwater for drinking and cooking and 71% for hygiene (Picture 8), while the similar numbers of primary and secondary source were 100%. Secondly, whereas only 18% - 27% used the water from primary and secondary sources for laundry or bathing, 93% of the RWH households used rainwater for laundry and 78% for bathing. In other words, a rainwater harvesting tank fulfils the water needs only partly but reduces the need of bathing and laundry trips to sources outside the house and saves time for other things. According to the rainwater harvesting study of RWSSP-WN (Dahal et al, 2010), the main reasons for not using rainwater for drinking and cooking in hilly Nepal are lack of knowledge that rainwater is drinkable, being habituated to previous sources and poor water quality due to inadequate operation and maintenance. The kitchen garden and toilet numbers are affected by the fact that not all households had toilet or kitchen garden.

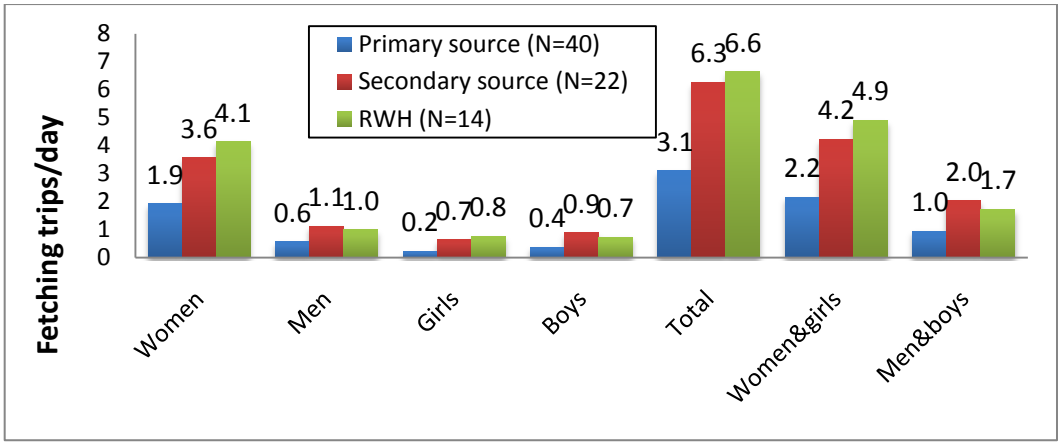



**Picture 8 Water use purposes of RWH, primary source and secondary source (HH Survey 2011).**

### 5.1.5 Water fetching trips

The households were asked about fetching time without queuing time, because queuing differs very much during the day, year and different years. The queuing period and months were however asked from many households as an extra question and it became clear that the answers were very subjective. For example one household reported that their secondary source has a 2-hour-queue every day during 4 months while another household said that they never need to queue on the same source. One reason can be that the people go to the source on different time during the day. The exclusion of queuing time makes a bias on the results but it is better to under than over estimate the time used for water fetching.

The number of round trips to primary source was in average 6.25 per day per household respective 6.64 trips to secondary source (Picture 9). Boys and girls were defined to be under 18 years old. Women carried out the most trips and were followed by men. Girls carried out a bit more trips to secondary source whereas boys carried out more trips to primary source. Also the women-men ratio favoured women to secondary source and men to primary source which indicates that females were doing the longest trips. On the other hand, in 28% of the households all trips were carried out by women only and in 7.5% of the households by women and girls. In 7.5% of the households the women did not fetch water at all. As rainwater harvesting trips are very quick and easy, their diversion does not give information about the struggle of water fetching but about who is using the rainwater in the household.




**Picture 9. Daily water fetching trips carried out by women, men, girls and boys (HH Survey 2011).**

### 5.1.6 Total fetching time and Quantity

As the fetching time from a rainwater harvesting tank is likely to be very short and there is no possibility for queue, it is excluded from the fetching time calculations. All households reported similar numbers of trips to their primary and secondary source, so the season seems to affect the time used for water fetching but not the quantity fetched. The average roundtrip time to primary source was 26 min respective 40 min to secondary source. The weighted average fetching time of all reported 62 primary and secondary sources was 31 min. The shortest roundtrip time was 5 min and the longest 120 min. The total daily fetching time per household was 210 min (3.5 hours) and per person 34 min. SPSS was used to weight all averages with the actual number of people who live permanently in the households and the actual roundtrip times, water quantities et cetera. The fetching times are subjective and must be treated with caution. However, the author verified one walking distance to be correctly estimated by the respondents and in many cases the neighbours reported similar minutes to the same source.

The daily quantity of fetched water in a household varied between 20 and 225 liters and was in average 94.5 liters. The daily per capita quantity averaged in 16.2 liters and varied between 5.6 liters and 30 liters. This means that none of the households exceeded the daily per capita demand of the proposed scheme (30 lpcd). Households with RWH were fetching slightly less water than the others (Table 7).

**Table 7. Daily amount of fetched water per capita in households with and without rainwater harvesting.**

| | Average (liters) | Median (liters) |
|---|---|---|
| RWH (N=14) | 15.5 | 12.5 |
| No RWH (N=26) | 16.7 | 15.5 |
| All households (N=40) | 16.2 | 15.0 |

*Source: HH Survey 2011*

### 5.1.7 Health and hardship

The water-related health aspect was taken into consideration in the household survey with the major water-born disease diarrhoea as an indicator. The households were asked about the number of person days when they suffered from diarrhoea during the

last year and about the cost of medical treatment caused by that. The adult and child days were separated, because the children are less likely to do economic activities when not ill. Nine (23%) of the households reported diarrhoea and 2.5% reported diarrhoea costs. The total monthly number of children days suffering from diarrhoea in the sample was 19 (0.48 days/HH) and the number for adults was 59 (1.48 days/HH). The sum of adult days is heavily affected by one household which reported 4 days every month (48 days/year). The only household which reported diarrhoea costs said 700 Rs. The other ones did not have treatment, got free public service or used home treatment methods. Such a high health level is rare in Nepal where more than half of the people are still without toilet and numerous children die due to lack of sanitation and hygiene.

The households were also asked about their opinion on their present water supply situation giving the options no troubles, small troubles and big troubles. 15% said no troubles, whereas small and big troubles were experienced by 43% each. When asking "How much money does your household spend for water per month?" 93% answered 0 Rs. The remaining three households said that they give sometimes money for the rehabilitation of their used sources which were kuwas and other natural sources as improved water supply has not yet been implemented in the area. Two of the households reported a not monthly but yearly cost of 4500 respective 30000 Rs whereas the third one paid 20 Rs some years only. These numbers reveal that direct and regular water costs will be something entirely new for the majority of the households.

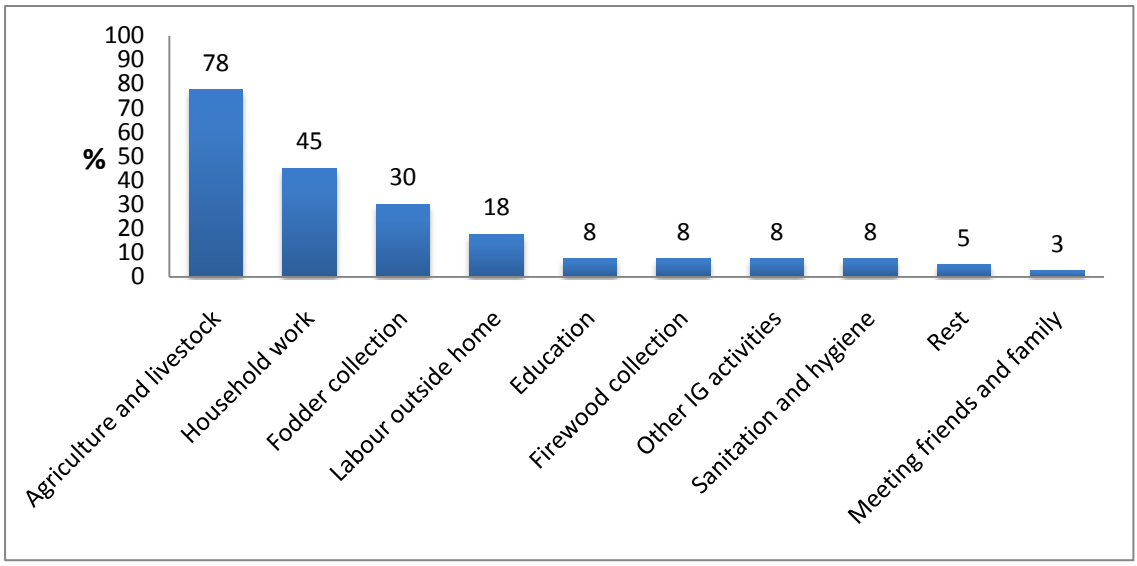
### 5.1.8 Conclusion

To conclude the present water management part of the household survey, there is significant demand for improved water supply: The average daily fetching time per capita was 34 min and roundtrip time 31 min, fetched amount of water per capita was 16.2 liter per day and only 15% experienced no troubles with their current water supply situation. On primary source, 30% experienced quality problems and 72% accessibility problems. Women and girls conducted just 2/3 of the trips which indicates improved gender equity in the area.

## *5.2 Social Feasibility*

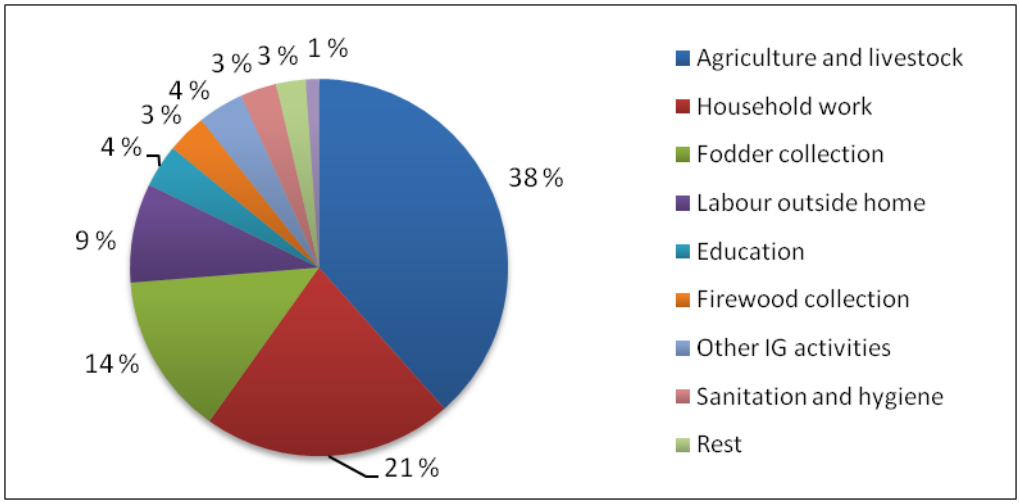
### 5.2.1 Estimated use of saved time

The households were asked how they plan to use the time saved after the scheme is completed. No options were given: the households could freely rank 5 most important tasks which were then categorized by the interviewer. None of the households could say five things but all mentioned at least one. Picture 10 describes the percent of households which mentioned the different activities how to use the saved time. Agriculture and livestock was mentioned by an impressive number of 78% followed by household work (45%) and fodder collection (30%). Resting (5%) and meeting friends and family (2.5%) which are the only activities which can be assumed to be free time are the last ones on the list. The weakness of these results is that agriculture and livestock were not separated in the questionnaire.




**Picture 10. Estimated use of saved time as % of households which mentioned the activity (HH Survey 2011, N=40).**

To get some approximation of the time distribution between the activities, the activities were given 5 points from each household which ranked them first. The secondly ranked got 4 points, the third 3, the fourth 2 and the fifth 1. The point distribution between the activities is shown in Picture 11. The order of the activities is very similar to the order in Picture 10.




**Picture 11. Distribution of saved time using ranking points (HH Survey 2011, N=40).**

Agriculture and livestock, fodder collection and firewood collection are the activities which might have biggest environmental impacts. Agriculture and livestock, fodder collection, labour outside home and other IG (income generating) activities in turn have the biggest economic potential. The combined percentage of these economic activities using the ranking points is as high as 68%. Increased practising of agriculture and livestock can also increase the water demand which might cause challenges because of the scarce daily design of 30 liter per capita.

Also the women in Focus Group Discussions (FGD, 2011) were asked to rank the use of saved time. The rankings of the groups can be seen in Table 8. The focus group in ward

number 7 told seven different ways to use the saved time. A notable difference to the household survey results were the absence of household work which had been mentioned in 45% of the households. Another interesting difference was that taking care of the children and aged was not mentioned in any household but the focus group in ward no 7 gave high priority (3rd) to it. It is possible that the interviewed households considered taking care of children and elderly as a part of household work. Also translation might have caused biases.

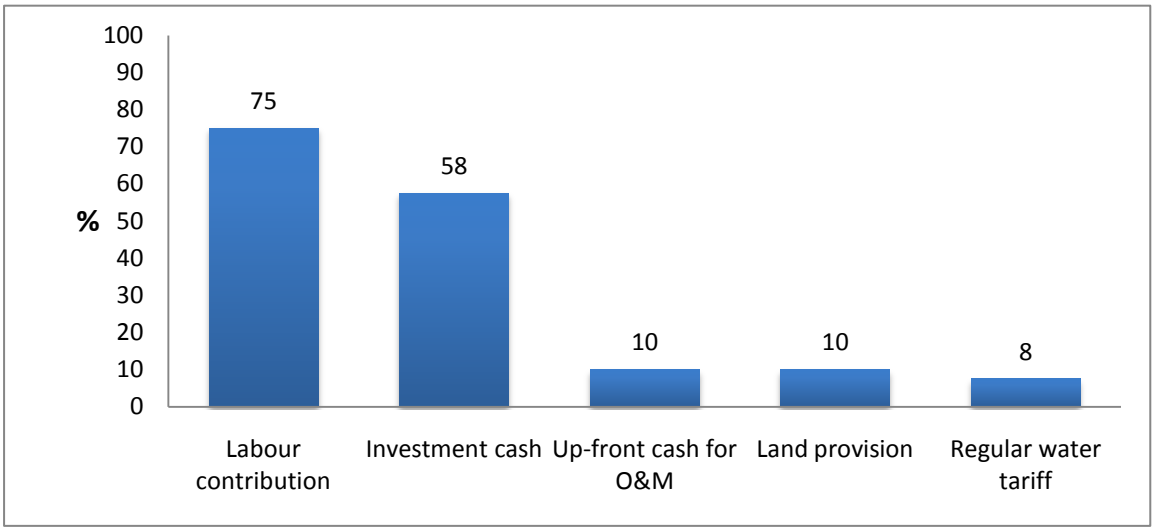
**Table 8. Estimated use of saved time in priority order according to women.**

| Ranking | FGD in ward no 7 | FGD in ward no 5 |
|---|---|---|
| 1. | Agriculture/livestock | Agriculture and livestock |
| 2. | Other IG activities | Education |
| 3. | Taking care of the children and aged | Other IG activities |
| 4. | Education | |
| 5. | Sanitation and hygiene | |
| 6. | Firewood collection | |
| 7. | Fodder collection | |

**Source: Focus Group Discussions with women, 2011**

### 5.2.2 Knowledge of the scheme

The households were asked "Do you know what kind of contribution is expected from the household side?" to find out if they knew their roles and responsibilities for the scheme. This was done after questions about their numeral willingness to contribute to up-front cash for investments, to up-front cash for the O&M fund, to regular water tariff and labor contribution for construction works so in theory, the question would have been easy to answer correctly. Only the fifth possible contribution (land provision) was not discussed before. Only 5% of the households mentioned all these five things. 5% could not say anything and 10% mentioned money in general. Labour contribution was highest with 75% (Picture 12). Investment cash knowledge was high (58%) but up-front cash knowledge was low (10%) so it seems to be difficult to understand or remember that a part of the collected cash is for future needs and not construction works. The knowledge and understanding of the regular water tariff might be so low (8%) because the people have been thinking about the implementation phase only or because they did not know or understand the tariff even if the willingness to pay the tariff was discussed some minutes before. The number of land provision might be low (10%) because it does not affect all households.




**Picture 12. Knowledge of the expected household contribution (HH Survey 2011, N=40).**

When asked "Who decides the water tariff?" 45% of the households could tell the correct answer that is by WUSC. The source name Makaimro is in the name of the scheme, but the households were asked about the distribution chamber location. 45% could tell the place (Deuthan) so they knew from where the water will be distributed forward. The households were asked if they know the location of the nearest tap. 20% did not have any idea whereas 73% of the households knew the location and 8% could say that it was not fixed yet. From commitment aspect, a sufficient level of scheme knowledge would be that the people know and understand why they have to pay, what is the service level they will get and how can they get their voice heard if they have ideas, complaints or interest to know more.

### 5.2.3 Source acceptance

The respondents were asked about their opinions on the source quality, quantity and if there is a better source available or not. 45% of the households thought that the water quality of the source is good for the scheme. The remaining 55% did not know the source or its quality, so no one was dissatisfied. 40% thought that the source yield is enough for the scheme whereas 58% did not know the source or its quantity, so the remaining 3% were dissatisfied. This household did not have an idea about a better source whereas 2 households (5%) were satisfied with the quality and quantity of the proposed source but had the opinion that there is an even better alternative source with adequate water yield. According to key informants, the yield and water quality of the proposed sources Ramdi khola and Bharlan khola are not sufficient. The remaining 95% were satisfied with the proposed primary source, Makaimro. Also the key informant interviews and the focus group discussion in ward no 7 verified that the source is accepted and no conflicts have risen. To conclude these answers, many people were satisfied with the proposed source or did not see the source relevant as long as the water will come from somewhere.

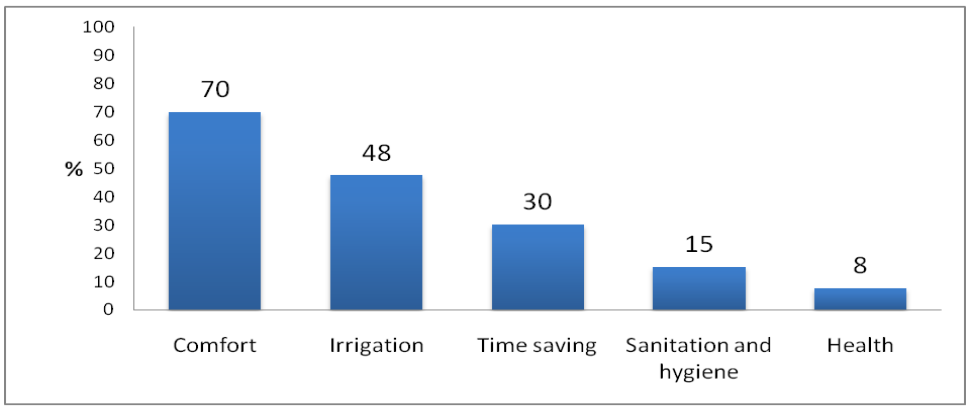
### 5.2.4 Scheme acceptance

As mentioned before, 73% of the households knew the location of their nearest tap stand. 93% of these households were satisfied with the location whereas 7% (2 HHs) were dissatisfied. Because of limited yield of the present sources as well as high price and limited availability of electricity, the scheme design is only 30 liters per capita per day (lpcd). In the National RWSS policy (MPPW, 2004) the basic level of water supply is defined by 45 lpcd and in no case less than 25 lpcd for gravity system so there is room for discussion about the rationality of this design. When asked about satisfaction with the design quantity, only 63% of the households said that 30 lpcd is enough for them. The costs, advantages and willingness to pay for more water should have been discussed in the design phase.

The households were also asked about their willingness to give land for structures to find out if there were some conflicts or dissatisfaction. 15% did not know if structures were proposed on their land, 78% said that they are not proposed and 8% said they are proposed. These three households were asked to give land for pipeline (ca 100 $m^2$), reservoir tank (ca 12 $m^2$) and tap stand (ca 2 $m^2$). All of them were willing to give the land free of cost and were in the process of making an agreement with WUSC about the land use. According to key informant interviews (KII, 2011), there had not been conflicts about giving private land for structures.

### 5.2.5 Opinions and expectations about the scheme

The households were asked about the scheme benefits with an open-ended question "What kind of benefits do you expect from this scheme?" As seen in Picture 13, most households (70%) mentioned comfort which was followed by irrigation (48%) and time saving (30%). Sanitation and hygiene was mentioned by 15% and health by 8%. These results indicate that increased quantity and accessibility of the water are preferred neither than the quality and health. One explanation is that the people do not know the health benefits of the scheme or because only 23% of the households reported diarrhoea during the last year and therefore water-borne diseases are not a common issue. The high irrigation expectation of 48% indicates that the upcoming demand of water might become high. The key informants (KII, 2011) supposed that the people will understand to do micro-irrigation only.




**Picture 13. Expected benefits from the scheme mentioned by the households (HH Survey 2011, N=40).**

All forty households were asked the open-ended question “How should the scheme information be distributed?” During the analysis, the answers could be roughly divided into two categories: door-to-door information and meetings. Five households said something about both. Nine households proposed mass meetings, whereas 10 households mentioned cluster meetings. 6 households mentioned meetings in general and 15 did not say anything about meetings. 11 households wanted to have information from person to person, whereas 8 households wanted to get it from a key person like WUSC member or cluster messenger. One household mentioned both person-to-person and key person information. Other ideas to distribute information were mobile phone, school, notice board and to make compulsory that someone from every household attends meetings. One household said that it should be compulsory to inform other people about what is happening in the scheme and one that every household should be informed about a cluster meeting before having it.

The answers reflect clearly that the distribution of information had not been sufficient. Among the ones who wanted person-to-person information (N=11) 82% thought they had got enough information about the scheme, which was also asked in the questionnaire. Among the ones who wanted information from a key person (N=8), only 25% were satisfied with their information level. This might indicate that some households are in the inner circle with easy access to information, while others are left outside and wish more organized and formal informing. None of the WUSC members (KII, 2011) admitted problems when asked “Has the information distribution been successful?” One of them said though that it is demanding with so many groups and castes. Another one said that the people might say they are not informed even if they actually are. WUSC members can not be blamed about the informing problems as there is no detailed framework and rules about how and by whom the households should be involved and informed. 265 households are too much to be informed by 11 WUSC members alone and the role of service provider was not clear.

WUSC is planning to collect an equal monthly water tariff of 200 Rs from all households and not have meters on the public taps even if they are in the design. The households were asked to choose one of three options how the monthly water tariff should be decided. Fixed tariff per household was preferred by 25%, fixed tariff per person by 13% and according to the used amount of water measured with a water meter on the tap by 60%. It is not clear if the households were thinking about water meters on private taps, water meters on public taps or if they understood what water meters are. However it is obvious that the majority of the households were interested about paying according to the used amount of water. In reality a water meter on the tap might create big disputes among the tap members who should share the bill together. On the other hand, a unanimously poor tap stand group could cut down their water bill significantly and leave a bigger share of water and costs for the ones who can afford more if the water meter system was released on the scheme area.

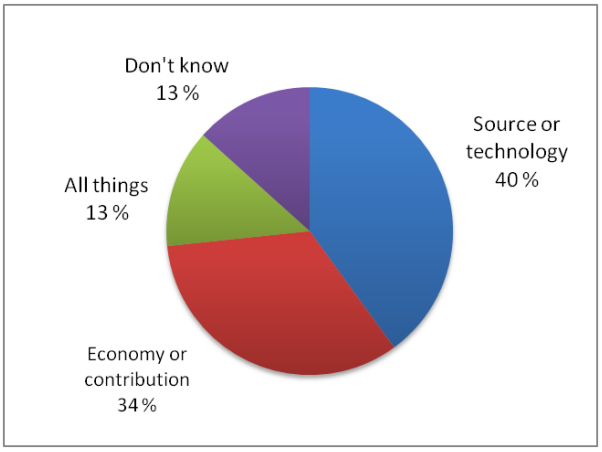
When asking how the tariffs should be decided according to the income status, 63% of the households thought that all households should pay the same water tariff whereas 38% of the households preferred that the poor households should pay less and the wealthy households should pay more. The average of yearly income was 20% higher

(137 120 Rs) among the households which wanted equal tariffs for all than among the ones preferring cross subsidization (114 173 Rs).

### 5.2.6 Participation in scheme implementation and success of informing

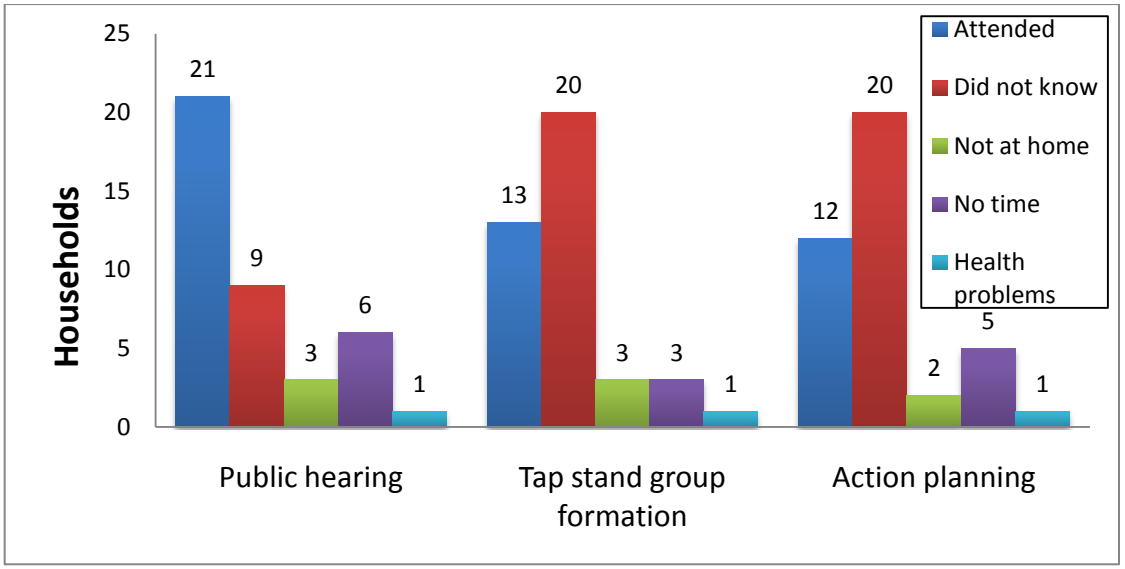
Only one household (3%) had been asked about ideas when designing the scheme but could not tell what had been asked. This percent might be understated because not all family members where present in the interviews but can be considered very low.

63% of the households thought that they had got enough information about the scheme which means that more than one third were dissatisfied with the amount of information they had got. The people who were dissatisfied with the information level (N=15) were asked to define what they would like to know exactly. Among these fifteen households, six wanted more information about the source or technology (Picture 14), five wanted to know all or many things (not defined more specific) and two wanted information about scheme economy or contribution. Two households could not define what they wanted to know. Many people found the lifting system very interesting and some kind of miracle because water usually flows down and not up. All these things were explained in the public hearing which is a meeting where the scheme is presented by the district and accepted by the community. It seems like the people did not attend, listen or understand. As more than half of the households were satisfied with their information level but only one household were asked about ideas, there had been informing but it was one-sided and not participatory.




**Picture 14. What did the households want to know more about the scheme (HH Survey 2011, N=15).**

Three mass meetings about the scheme had been organized before conducting the household survey: public hearing, tap stand group formation and action planning. The households were asked about their attendance and reasons for not attending. 53% of the households attended public hearing (Picture 15) but 23% did not know about the meeting at all. An alarming number of 50% did not know about tap stand group formation respective action planning. The other reasons for not attending were similar in all three meetings: not being at home, other time problems and health. The time problem was usually specified as being busy with agriculture or household work. No one said that they did not come because of lack of interest which can be considered very positive even if it might not be the complete truth and some of the ones without information about the meeting might not have been interested. In total 42 of the 50 people who attended the meetings from the interviewed households where males and only 8 females (84% vs. 16%). All these numbers might be affected because not all household members attended the interview.




**Picture 15. Attendance and reasons for not attending the mass meetings regarding the scheme (HH survey 2011, N=40).**

### 5.2.7 Institutional Status of WUSC

Makaimro WUSC was visited 5 weeks after the beginning of construction works by specialists of RWSSP-WN to monitor the construction works and institutional status. According to the RWSSP-WN strategy, Water Users and Sanitation Committees should have at least 33% women and ensure proportional representation of gender, caste and disadvantaged ethnic groups. In Makaimro WUSC, four (36%) of the members are women. Among the three key positions (chair, secretary and treasurer) two are Adibasi-Janjatis and one is Brahmin-Chettri. The total ethnical composition is 1 Dalit, 1 Muslim, 4 Brahmin-Chettris and 5 Adibasi-Janjatis and therefore all ethnical groups of the scheme area are presented. However, only active participation relates to proper involvement and therefore statistics for only physical presence do not guarantee anything about who is actually doing the decisions and getting his or her voice heard.

At that time, all the investment cash from the community was collected and deposited in bank (450 Rs/household). Of the up-front cash for the operation and maintenance fund, 189 Rs out of 890 Rs was collected. In practice, WUSC had collected 1400 Rs from the households which wanted and could pay and only a part or nothing from the ones which disagreed. Therefore, 47% of the total up-font cash was collected. The construction works had begun from the source, electricity line and transmission line which are the most difficult parts due to need of skilled workers and difficult accessibility. Electrical works were completed and the aim was to finish all works up to the distribution chamber in 6 weeks. According to the specialists of RWSSP-WN, the speed of the construction works was exceptional (Picture 16). It needs to be mentioned though that the workers were from ward no 7 were all interviewed households agreed with all required contributions and 91% attended public hearing. The trust and willingness in other wards might still be lower. The trust on the success of the scheme is likely to increase when the works progress and the villagers can see that water is really coming but the willingness to contribute can not be guaranteed. The five operation and maintenance workers were already selected and WUSC had held nine meetings in total.

**Picture 16. Constructing the collection tank of Makaimro LWSS (Photos: Bimal Sharma)**

### 5.2.8 Other aspects of interest

During the household survey, many things came to the mind of the interviewed people. They were allowed to unburden themselves freely before going to the next question. Those aspects can not be used as quantitative, exact data but are described here because they have qualitative value. As mentioned in the water management practice section, only three households admitted to spend money for water. Many wanted to explain that the time their household uses for water fetching is worth money and therefore they have much indirect costs. This indicates that not only comfort but the economic value of the saved time and therefore improved water supply was understood and be used as a tool when convincing the people to pay for the water.

It was found out during the HH survey that many people did not trust the scheme because there had been several failed scheme plans before implementing Makaimro lift water supply scheme under the support of RWSSP-WN. Some people had even paid up-front cash for a scheme funded by Japan and never got advantage of it. According to the key informants, the other successful WASH activities had helped to increase but still not completely gain the trust of people. On the other hand the people will inevitably get more and more trust and information during the scheme implementation without any special tricks because the construction works are very visible, concrete and lead to water supply which must be the dream of many villagers. Nevertheless, long-term willingness and trust are the most important things.

During the household survey it came up that 5 households in one of the clusters (Chiti Swara) were going to have the tap stand far away from their houses due to their high elevation. These households were asked to contribute in the construction works and cash expenses like other households but with a significantly lower service level improvement as their present source was close to the proposed tap stand. The altitude and fetching time were not measured exactly. The people were disappointed and did not know if it is technically or economically possible to solve the problem. When WUSC members were interviewed about their opinion case a few days later they were

planning to make a tank and pump for the houses with finance from VDC. Either the plan was done after (and maybe because of) the interviews in Chiti Swara or then the households were not informed about plans affecting themselves more than any others.

When key informants were asked about the biggest challenges regarding the scheme in their personal opinion, they mentioned affordability of the poorest people, absence of young people in the community (as there is higher migration rate of youths going to work abroad) who could fulfil the labour contribution, lack of skilled workers, electricity, technical system in general and financial problems.

One poor HH survey respondent said that if they have to attend construction works and can not go to their field, they will not have food to eat. In one key informant interview a WUSC member said that the extremely poor households will be identified and not requested to do the labour contribution days.

## *5.3 Economic feasibility*

### 5.3.1 O&M Aspects

The regular O&M costs are estimated in this chapter. According to scheme design report (P.U.R.D, 2011), the pumps on both stages need a capacity of 7.5 kW to lift the water with a pumping rate of 2 l/s and will work 6 hours in the morning and 6 hours in the evening. This makes a monthly electricity demand of 5400 kWh. With these pumping hours and the base year population estimate of 1740 there would be 45 lpcd available for the people adding 10% for non-domestic use. To reach 30 lpcd only, the required pumping hours would be eight (3600 kWh) but the estimate is done using the designed pumping hours. The electricity price of 4.15Rs/kWh from 11 kV power line for water supply is taken from the report of NEA (NEA, 2010). WUSC can try to apply for a cheaper electricity price of 3.50 Rs/kWh which can be given if the water is used for irrigation. The cost of chlorination and minor repairs like spare parts for tap stands was estimated by the PSU. The salaries of the pump operators and maintenance workers have been decided by WUSC. The calculations in Table 9 are done using 265 households as in design.

**Table 9. Estimated regular O&M costs of 265 households in base year 2012.**

| Component | Unit price | Unit | Total/month | HH/month | % |
|---|---|---|---|---|---|
| 5400 kWh of electricity | 4.15 | Rs/kWh | 22410.0 | 84.6 | 42.3 |
| Salaries for 2 Pump Operators | 5000.0 | Rs/OW/month | 10000.0 | 37.7 | 18.9 |
| Salaries for 3 maintenance workers | 2500.0 | Rs/MW/month | 7500.0 | 28.3 | 14.1 |
| Minor repairs | 5000 | Rs/month | 5000 | 18.9 | 9.4 |
| Savings for irregular costs | | Rs/month | 8100 | 30.6 | 15.3 |
| Total | | | 39910 | 200.0 | 100.0 |

**Sources: NEA, PSU, Key informant interviews**

According to this breakdown estimate, 15% of the collected money can be saved and used for irregular costs like unexpected repairs, rehabilitation or insurance. Additionally, if 15% of the households do not pay the tariff there will be nothing left for irregular costs. In this cost estimate, insurance against natural hazards is not taken into account because it is not obligatory for the O&M of the scheme. After active co-

operation with Rural Water Supply and Sanitation Fund Development Board (RWSSFDB), a World Bank/IDA supported water and sanitation project in Nepal, National Life & General Insurance Company has been providing insurance since last year with the yearly price of 2.40 Rs per every 1000 Rs of investment costs of water supply schemes (0.0024% of the investment costs). According to the report (RWSSFDB, 2010) many communities have been eager to take the insurance policy and the average monthly cost per household has been less than 5 Rs. This insurance provided by NLGI covers flooding, earthquakes and landslides. With the estimated investment costs of Makaimro LWSS the insurance would be 8.9 Rs/HH/month and reduce the saving for irregular costs to 11%. However, the most useful insurance in a lifting scheme would be insurance against lightning to protect the pumps and other electromechanical components. This fire insurance is under discussion with NLGI. If a contract between WUSC and the company will be made, the insurance tariff is likely to be relatively high because pump damages are unpredictable and expensive to cover as the cost of one pump of 7.5 kW capacity used in Makaimro LWSS is 75 000 Rs (PSU, 2011). If the water tariff will not be enough for the O&M costs and needs to be increased soon, this might cause dissatisfaction and disappointment among the users.

### 5.3.2 Willingness to pay (WTP) and contribute

The willingness to pay for improved water supply was asked in many stages. First, the very general question “Are you willing to pay something for improved water supply?” was asked. Secondly, the households were asked how much they are willing to pay in different categories (e.g. up-front cash, labour contribution, regular water tariff) using open-ended questions. After some questions on scheme knowledge, the willingness was tested again but this time with the actual designed contribution amount of 1340 Rs for up-front cash, 38 days for labour contribution and 200 Rs as regular water tariff. If the households did not agree the contribution criteria, they were asked what they want to pay. Compared to the initial questions, the households were given more explanation about the use of the money or tasks during the labour days. Later in the survey, the households were asked the question “How are you going to cover the monthly tariff?” and given options.

85% of the households said that they are willing to pay “something” for improved water supply and 95% said they are willing to pay the up-front cash before the scheme is finished. The latter question was asked to find out if the people agree with the custom of paying before they actually have the water. 63% of the households said “as needed” for the labour contribution and the remaining 38% gave answers between 0 and 15 with the average of 3.8 days (Table 10). As mentioned above, the theoretical up-front cash from the scheme estimate is 1340 Rs/HH. The households were not given information on this or other contribution numbers even if many asked for them. 38% of the households ended up to answer the very co-operating “as needed”, while the remaining 63% gave answers between 0 and 4000 Rs with the average of 1115 Rs or could not answer. Only one household said 0 Rs. For regular contribution, 48% were ready to pay “as needed” whereas the remaining households wanted to pay 0-400 Rs (average 114 Rs).

**Table 10. Willingness to pay when asked open-ended questions (N=40).**

| Requirement | "As needed" in% | Average of others | Range | How many HHs said 0 |
|---|---|---|---|---|
| Labour days (days) | 62.5 | 3.8 | 0-15 | 12.5% |
| Up-front cash contribution (Rs) | 37.5 | 1115 | 0-4000 | 2.5% |
| Regular water tariff (Rs) | 47.5 | 114 | 0-400 | 0% |

*Source: HH Survey 2011*

Next, the households were asked about willingness to contribute the exact required amounts. The up-front cash got the widest acceptance of 83% (Table 11) whereas the labour contribution and regular cash contribution were each agreed by 73%. 63% of the households agreed with all three requirements. These numbers are strongly affected to both directions by the fact that one number was given as a primary option and no amounts above that could come up.

**Table 11. Willingness to pay when asked to contribute the required amounts (N=40).**

| Requirement | Agreed | Average WTP of all HHs | Average WTP of those who disagreed | Range of the disagr. | How many HHs said 0 |
|---|---|---|---|---|---|
| 38 labour days | 72.5% | 28.65 days | 4 days | 0-10 days | 5% |
| 1340 Rs as up-front cash | 82.5% | 1158 Rs | 300 Rs | 0-500 Rs | 5% |
| 200 Rs/month regularly | 72.5% | 161.25 Rs | 59 Rs | 0-100 Rs | 2.5% |
| Willing to contribute all 3 | 62.5% | | | | |

*Source: HH Survey 2011*

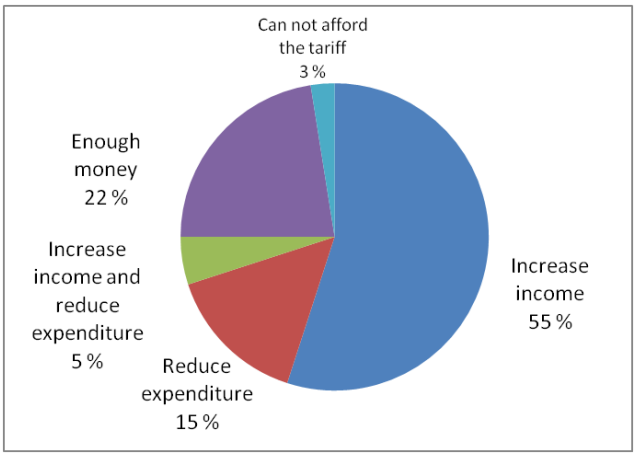
Accepting the “as needed” answers in the initial stage and not requiring an exact amount was an aware choice by the author and can be criticised because no quantitative value to calculate averages was gathered. The qualitative value is anyhow interesting. “As needed” in the initial stage can have been so popular because the people might have been afraid of promising too big numbers, even if “as needed” is theoretically unlimited and therefore the biggest possible promise. Maybe they did not know how what kind of number is realistic. It was interesting to see, where the initial willingness expressions of “as needed” lead. Out of the 15 households which were initially willing to pay as needed for up-front cash, one disagreed with the actual requirement. With labour contribution similarly one disagreed (N=25) and with regular contribution (N=19) two disagreed. Therefore most of the households were still willing to fulfil their initial willingness and contribute as required. All four disagreements come from different households.

As a subjective guess from the author, some of the “as needed” households wanted the water so much that they were ready to pay big sums within their affordability, whereas some other just could or did not want to say a number out load. It would be easier for the people to measure the value of an exactly defined and explained improvement in the service than to value a service which does not yet exist and is unfamiliar for the beneficiaries. For example the willingness to pay for more electricity or longer service hours could be easier to define as the households in Thaprek already have electricity.

Another interesting thing is, if the willingness to pay of the households increased during the second questions now that they had more information and the realistic, designed

knowledge of the costs which were required. When excluding the "as needed" households and analysing the households which did not agree with 38 days finally, 5 said the same number as initially whereas 5 increased the amount. With up-front cash contribution, 2 increased, 2 decreased and 2 kept it the same. With regular water tariff, 7 households kept the amount same whereas 2 households decreased it. These results indicate that the willingness is very inconstant and strongly affected by the moment, more information and knowledge of the exact amounts. This is also supported by that 20% of the households wanted initially pay 1400 Rs as up-front cash which was exactly the amount already collected from some households.

Later in the HH survey, the households were asked the question "How are you going to cover the monthly water tariff?" because raising the money is the most critical economic factor regarding to the success of the scheme. Only one household said it can not afford the tariff (Picture 17) but also only 9 households (23%) said they have enough money. Most of the households (75%) were planning to increase their income or reduce their expenditure to meet the amount for regular water tariff.




**Picture 17. Ways to cover the monthly water tariff (HH Survey 2011, N=40).**

The households were further asked how they planned to increase their income or reduce expenditure. The increasing of income (N=24) was dominated by labour (71%) followed by livestock (21%) and both labour and livestock (8%). Of the eight households which wanted to reduce their expenditure, 50% wanted to eat cheaper and/or less whereas the other half wanted to eat cheaper and/or less and also buy cheaper products.

According to these survey results, the people will definitely pay the water tariff if they have the opportunity to increase their income. As 60% of the households wanted to increase their income, the key informants (KII, 2011) were asked if there really is facilities available for that. One of them said that skilled people can easily do income generating (IG) activities with help of more time and water but the unskilled can not. In other three interviews the participants did not express their worry about the unskilled and said that people will be able to do IG activities like agriculture, livestock, kitchen garden and honey easily because of more time and water. RWSSP-WN were planning to provide some training to increase the skills but it is however not sure if the willingness to pay can really be turned out to capability.

### 5.3.3 Possible reasons for differences in WTP

Due to small sample size of 40, possibility for statistical testing about correlations between willingness to contribute and other factors was limited. $\chi^2$ independency test was only possible with big and rough categories like yes and no. Descriptive cross tabulations could be done even when the $\chi^2$ independency test was not possible. The

households were asked about three kind of willingness to contribute: the required up-front cash, the required regular cash and the required labour contribution. In this chapter these three things are combined as a total willingness with categories yes and no. Therefore the households are divided to two groups: those 25 households (63%) which agreed with all three requirements and those 15 households (38%) which disagreed with one or more. Table 12 represents the number of households in different wards accepting all three contributions. A remarkable notice is that the interviewed households in ward no 8 have the second highest income but only 42% accepted all three contributions whereas all households in ward no 7 accepted everything but their average income was lower than in ward no 8. This indicates that money was not the only reason for willingness differences on the area. The percentages of willingness to contribute and attendance in public hearing are rather similar. Among the eight poorest interviewed households (< 3500 Rs/month), 50% accepted all 3 contributions and 50% did not.

**Table 12. Willingness differences between the wards (N=40).**

| Ward no | 5 | 6 | 7 | 8 | 9 | Total (N=40) |
|---|---|---|---|---|---|---|
| Interviewed HHs (number) | 13 | 1 | 11 | 12 | 3 | 40 |
| Accepted all 3 (number) | 5 | 1 | 11 | 5 | 3 | 25 |
| Accepted all 3 (%) | 38.5 | 100.0 | 100.0 | 41.7 | 100.0 | 62.5 |
| Attended public hearing (%) | 30 | 100 | 90.1 | 41.7 | 66.7 | 52.5 |
| Average yearly income (Rs) | 113200 | 250000 | 131636 | 140917 | 93333 | 128515 |

*Source: HH Survey*

The correlation between willingness to contribute and satisfaction with information level could be tested statistically using $\chi^2$ independency test. The cross-tabulation of the results is shown in Picture 18. 72% of the households which were satisfied with their information level agreed all three contributions compared to 47% among the others. The p value was found out to be 0.048 < 0.05. As 95% was chosen as confidence level, there is statistical evidence that households which thought they had got enough information had more willingness than the others.

**Have you go enough information on this scheme? * Accepted all three contributions**

| | | | Accepted all three contributions | | Total |
|---|---|---|---|---|---|
| | | | Yes | No | |
| Have you go enough information on this scheme? | Yes | Count | 18 | 7 | 25 |
| | | % within Have you go enough information on this scheme? | **72.0%** | 28.0% | 100.0% |
| | No | Count | 7 | 8 | 15 |
| | | % within Have you go enough information on this scheme? | **46.7%** | 53.3% | 100.0% |
| Total | | Count | 25 | 15 | 40 |
| | | % within Have you go enough information on this scheme? | **62.5%** | 37.5% | 100.0% |

**Picture 18. Cross tabulation of willingness and satisfaction with information level (HH Survey, 2011, N=40).**

The correlation between willingness to contribute and attendance in public hearing was tested similarly. Picture 19 shows that the willingness difference between the households which attended or did not attend public hearing 86% and 37% is but as it is *too big*, the correlation can not be considered as statistically significant and confident. However, the reader can make his or her conclusions.

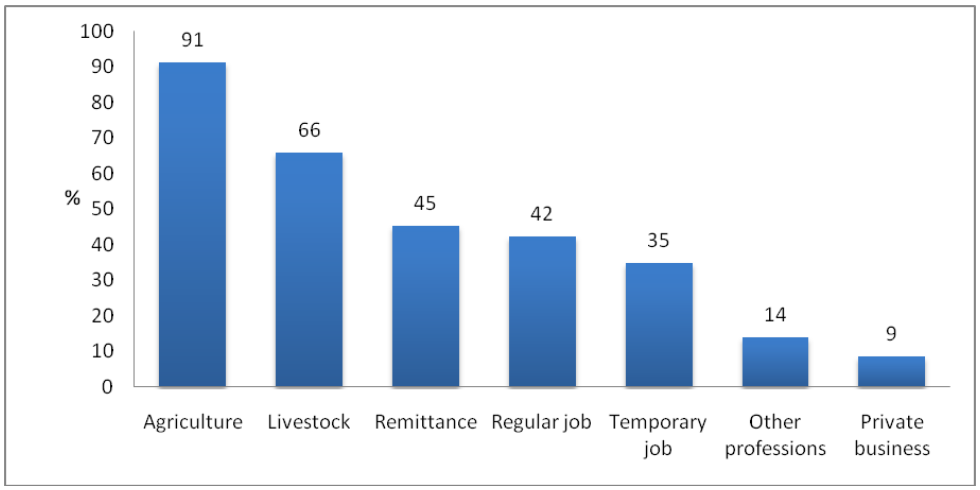
**Attendance in public hearing? * Accepted all three contributions**

| | | | Accepted all three contributions | | |
|---|---|---|---|---|---|
| | | | Yes | No | Total |
| Attendance in public hearing? | Yes | Count | 18 | 3 | 21 |
| | | % within Attendance in public hearing? | **85.7%** | 14.3% | 100.0% |
| | No | Count | 7 | 12 | 19 |
| | | % within Attendance in public hearing? | **36.8%** | 63.2% | 100.0% |
| Total | | Count | 25 | 15 | 40 |
| | | % within Attendance in public hearing? | **62.5%** | 37.5% | 100.0% |

**Picture 19. Cross tabulation of willingness and attendance in public hearing (HH Survey, 2011, N=40).**

### 5.3.4 Affordability to pay

It is impossible to define from outside who is capable to pay something and who is not. This is especially demanding on rural areas where the income is strongly affected by the season and year and therefore no statistics about income can give absolute estimations. All income sources of each household were asked in the baseline survey in the beginning of WASH activities in 2010. Agriculture (91%) and livestock (66%) nominated (Picture 20). Also remittance (45%) and regular job (42%) were represented highly which indicates availability of regular cash. 91% of the households carried out agriculture and are thereby partly of fully self-sufficient in food production. The households carrying out agriculture do not need as much cash as the others but their income is very vulnerable to weather conditions and prices of agricultural products. Therefore, affordability calculations are not as straightforward as in cities. Also the household sizes and therefore expenditures of the households varied.




**Picture 20. Income sources of the beneficiaries (Baseline Survey, 2010, N=229).**

The proposed monthly tariff of 200 Rs/HH is 1.87% of the monthly average household income of 10 710 Rs and 2.00% of the monthly mean household income (MHI) of 10 000 Rs (HH Survey, 2011). They are both below the often quoted water tariff guideline of a maximum 3.0-5.0% of household income (OECD, 2009). Using a threshold of 3.0% of the average income, the tariff is over the affordability of 20% of the households. Using a 5.0% threshold, 30% of the households fall under. According to these guidelines there is a significant need for cross-subsidization if the poorest households are not able to increase their income with help of willingness, increased time and increased water quantity. When asked about water tariff discount or exemption for poorest households, WUSC members said that it is possible but so far not in the agenda because increasing the income from the present is the primary method (KII, 2011).

When asked, one of the WUSC members (KII, 2011) who had personally been collecting up-front cash from the households gave the estimation that 70% of the households pay, 20% do not pay because they do not want and 10% because they can not. This is consistent with the 73% of households willing to pay 200 Rs according to the household survey. The five women from ward no 5 (FGD, 2011) said that the water supply situation is so troublesome that improvement is well worth the tariff. As mentioned before, only one household said that it can not pay the tariff. Only 23% had enough money and the rest planned to increase their income or reduce their expenditure. That indicates that the households see the tariff demanding but affordable.

### 5.3.5 Economic benefit-cost analysis

Benefit-cost analysis is a method used to evaluate all relevant costs and benefits of an investment. The aim of this study is to find out if the scheme if feasible, sustainable and beneficial for the community. However, this part represents a simple analysis of the monthly benefits and costs of the whole society including the investment costs coming from outside the community. This is called economic benefit-cost analysis. The scheme can be said to be beneficial and sustainable for the society, if the benefit-cost ratio is more than 1 which means that the monetary value of benefits is bigger than the costs are.

The regular O&M costs of the scheme are the monthly water tariff of 200 Nepali rupees (Rs) per household (1.9 €), investment costs and the up-front cash for O&M fund which

will be collected from the households. This analysis does not take into account that electricity tariffs are heavily subsidized by the government and cause therefore costs for the society. As the required land area for the structures is not significant and no land disputes came up during the study, the opportunity cost of land was excluded. The opportunity cost of the next best alternative use of the source was excluded because only cattle were using the water sometimes.

The main benefits of the Makaimro scheme that can be measured as money are increased health and increased amount of time that can be used to something else. For example a discussion paper by WaterAid (Redhouse et al, 2004) suggests that also energy consumption caused by water fetching trips could be taken into consideration in the benefit-cost analysis. Walking on the steep slopes of Thaprek requires indeed much energy but as the estimated use of saved time consists mainly of physical activities, the energy aspect was chosen to be excluded.

The households were asked about their present expenditure on water. Three households reported yearly rehabilitation costs of the tap/kuwa. Because the numbers were 20 Rs, 4500 Rs and 30 000 Rs, the average of these would end up in 63 Rs/HH/month which does not give a real picture of a mean household in the area as most people do not pay anything. In the FGD in ward no 7, some women mentioned that they boil or filter water but these water treatment costs were approximated to be minimal and no one reported treatment costs in the actual HH survey. Therefore the present water supply costs are excluded from the analysis.

According to WHO (2004), unsafe water supply, inadequate sanitation facilities and lack of awareness on personal hygiene cause 88 percent of diarrhoea attacks which are the major water-born disease. Thaprek is declared as an ODF (Open Defecation Free) area since 2010 and hygiene & sanitation education carried out by RWSSP-WN has been ongoing since one year targeting total behaviour change (TBC) in Hygiene and Sanitation. Therefore, improved water supply might be the last factor to stop water-born diseases. Not only the drinking water will be of safe quality but also carrying out hygienic behaviour like hand washing will be more attractive because of better water facilities. In the household survey, the average diarrhoea days of adults were 1.48/HH/month. To not overestimate the health impact of Makaimro LWSS, the economic value of one labor day per household per month was taken into account. The public health service costs were excluded as the usual cases only cost 30 to 50 Rs per patient (Adhikari et al, 2006) and only one household reported private costs of a case which required advanced treatment (700 Rs/year, HH Survey).

The bigger economic benefit of the scheme is the saved time. As mentioned before, the average time used for water fetching per household was 210 minutes (3 h 30 minutes) and does not consider queuing which makes the time less probably to be overstated. The households were planning to use most of the saved time for agriculture & livestock. Also other income generating activities were ranked highly and the water supply can play a significant role in the success of livestock and kitchen garden business. Approximately 25% of the trips were carried out by children but as water fetching is hard work, there is no reason to think that the children would not use at least a part of the saved time for some productive work in future also. Therefore the child and adult trips will not be separated in this benefit-cost analysis. Because the people will not have household connections, some time will be used for water fetching in future also. With

an estimation that the roundtrip to the tap stand including queuing and filling the jar takes 8 minutes, the used vessel has a quantity of 20 liters, all 30 lpcd water will be fetched and the household has 7.35 members like the sample population in the household survey including the ones abroad, the time used for water fetching in the future is estimated as 88 minutes per household. This makes the time saving 122 min/HH/day (2 h 2 min). Converted to labour days of 8 hours, the monthly number of saved time is 7.63 (7 and half) days. In reality, the water demand, supply and therefore fetching time can vary drastically during the year and between the households.

Handbook for the economic analysis of water supply (ADB, 1999) describes three ways to value the saved time from different sources: 50 percent of the market wage rate for unskilled labour, near or even above the market wage rate for unskilled labour or 51.5% of the rural market wage. In this study, the days of saved time were chosen to be given an economic value of 150 Rs/day which is half of the rate of the District Approved rate for unskilled labour in Tanahun year 2011 (300 Rs/day). The total benefits and costs during 20 years are presented in Table 13. As the Benefit-Cost Ratio is 3.3>>1.0, the scheme can be concluded to be very beneficial. The big questions remain: is it really possible to use the saved time effectively for income generating activities and is 200 Rs enough to cover all O&M costs? This analysis represents the net present value (NPV) of the benefits and costs assuming that the number of households, the O&M costs and value of saved time increases similarly during the design period and therefore no numeral discounting has been conducted.

**Table 13. Economic benefit-cost analysis of total costs and benefits during 20 years.**

| | Total during 20 years (Rs) | Consisting of |
|---|---|---|
| **NPV of total benefits** | **81090000.0** | |
| • Time saving because of water fetching | 71550000.0 | 7.5*150*265*12*20 |
| • Time saving because of health | 9540000.0 | 1.0*150*265*12*20 |
| **NPV of total costs** | **24783855.2** | |
| • Regular O&M costs | 12720000 | 200*265*12*20 |
| • Investment cost | 11827309.0 | as in design estimate |
| • Up-front O&M (2% of investments) | 236546.2 | as in design estimate |
| **BCR (Benefit-Cost Ratio)** | 3.3 | |

Sensitivity analysis was conducted to appraise the impact of changes in key parameters of the benefit-cost analysis. Change in water tariff, investment costs and value of saved time have been investigated. The results in Table 14 indicate that value of saved time is the most critical. The value and utilization of saved time has also direct impact on capability to pay the tariff.

**Table 14. Sensitivity analysis of the economic benefit-cost analysis.**

| Parameter | BCR |
|---|---|
| No changes | 3.3 |
| Regular O&M cost + 100% | 2.2 |
| Investment costs + 50% | 2.6 |
| Value of saved time -50% | 1.6 |
| Value of saved time -50% and regular O&M cost +100% | 1.1 |

The most important finding of this benefit-cost analysis is that from household point of view, the present estimated value of saved time (1275 Rs/HH/month) fairly exceeds the monthly tariff of 200 Rs. On the other hand, the value of the comfort when having

water supply close to the house were not valued in numbers but is definitely big as 85% of the people were ready to pay something for improved water supply and only 15% faced no troubles with water supply. Theoretically, if a household used all the saved time of 7.5 days/month (excluding the time saved because of health) for income generating activities, a daily wage of 27 Rs. would be enough to cover the tariff of 200 Rs/month.

## *5.4 Technical feasibility*

A scheme with significant technical problems is likely to fail and cause dissatisfaction among the users which reduces the socio-economic feasibility. This chapter discusses the technical challenges of the scheme. The themes discussed are landslide risk, water quality, water quantity, design optimization and challenges of operation and maintenance. The information was gathered from the scheme design and from the field.

### 5.4.1 Landslide risk around the sources

The environment of the sources Makaimro and Dharapani was observed during an observation walk conducted by the author and staff of service provider (observation walk, 2011). The sources are well hidden in forest at 370 m vertical and 1100 m horizontal distance from Thaprek-7 which is a part of the scheme area. The sources are located in a dense forest covered by grass and trees. The soil type is a moist mixture of sand, clay and rocks. In some places surrounding the source, rocks are small and loose. No current landslides or risk for that were observed around the sources. According to a key informant interview (KII, 2011) the inhabitants of Thaprek-7 who are among the beneficiaries will stop deforestation at a 500 m distance around the sources. This will preserve the vegetation which is a crucial part of avoiding landslides. The rock bed alignment was against the water flow direction at both sources which makes the rock bed more stable compared to alignment similar with the flow direction. However, deforestation due to the construction works might increase the landslide risk compared to the present situation.

### 5.4.2 Landslide risk around the transmission pipeline alignment

During the observation walk, the transmission pipeline alignment route was not fixed yet because the original design was considered as too steep. However, the slope is generally well covered with vegetation and the rock bed alignment is against the water flow direction. A detailed geotechnical survey has not been conducted but no current landslides were observed and the soil type was boulder mixed soil. The steep landscape has also the advantage of keeping animals and people away which reduces the risk of vandalism. The deforestation due to the new electricity line might increase the risk of landslides and damage the transmission pipeline which will be installed on the ground and be therefore vulnerable to external hazards like landslides. On the other hand, the transmission pipeline itself will cause geotechnical instability and breakage of soil and rock bed due to its substructure.

### 5.4.3 Water quantity and operation of the scheme

**Picture 21. The main source Makaimro (Photo: Laura Aaltonen).**

The water will be collected from two natural springs Makaimro (1.0 l/s) and Dharapani (0.2 l/s) which have a combined yield of 1.2 l/s. According to the design, 90% of the yield (1.08 lps) can be tapped for drinking. The technical design of scheme has taken 2012 as a base year and is designed to meet a water demand of 30 lpcd after twenty years (2032) with a population growth rate of 1.62%. Both pump stations will have standby pump sets of two pumps which are both designed to lift 2.0 l/s and operate alternately. The designed pumping hours are 6 hours in the morning and 6 in the evening. When operated 12 hours altogether, this will meet the demand of 45 lpcd for the population of the base year 2012. To meet 30 lpcd, the required pumping hours would be 8 only. The electricity cost per 30 lpcd is 56 Rs/HH/month whereas 45 lpcd costs 85 Rs/HH/month. It is beneficial to pump more water if the people can and want to afford it. Nevertheless, during load shedding months of the year even the design of 30 lpcd might be demanding to reach and during the rainy season the water demand will be lower. Therefore the actual pumping quantity and cost will vary during the year.

According to the design (P.U.R.D., 2011), both lifting stages will be operated from the intermediate pump house which is relatively easy to access. One of the biggest technical threats is lightning which can damage the pumps. If only one pump gets damaged the other one can take over until the other one is repaired but the cost of a new pump and earthing are 75 000 Rs + 12 000 Rs (PSU, 2011). If one set of 88 000 Rs will be broken every year, the monthly recovery cost shared between 265 households will be 28 Rs/HH/month. The pumps do not get damaged by the lightning if the pumping is stopped and the electricity unplugged when the weather turns unstable. Therefore, the professionalism and commitment of the pump operators is relevant and can prevent significant damages.

### 5.4.4 Design optimization

This part presents some technical alternatives for the chosen design. Some other electrical lift water supply schemes supported by RWSSP-WN have had the approach to have bigger pump capacities and shorter pumping hours which result in smaller O&M costs and better feasibility due to long load shedding hours during dry months in many parts of Nepal. The costs of an alternative design for the designed water amount 79 970 l/d (P.U.D.D, 2011) and lifting head of 370 m as in Makaimro LWSS are calculated in this chapter. According to design estimate software program of pump selection (Softwel, 2011), the designed water amount of this scheme could be lifted in 6 hours using a

pump of 15 kW to lift water up to 300 m and a pump of 4 kW for the remaining 70 m. Due to low pumping time demand of 3h+3h, single pumps would be enough. The investment costs and daily electricity costs of these two alternatives are compared in Table 15. Compared to the actual design, the investment costs of this optimized design are only 80% and electricity costs only 63%. The electricity saving with the optimized design would be 31 Rs/HH/month.

**Table 15. Investment cost and daily electricity demand of two pumping alternatives.**

| Time | Lifting heads | Pump capacity | Investment cost of pumps | Electricity, kWh | Electricity, Rs |
|---|---|---|---|---|---|
| 12 h | 200 m+170m | 7.5 kW + 7.5 kW | 4*75000Rs = 300000Rs | 12h*15kW = 180 kWh | 747 Rs |
| 6 h | 300 m+70m | 15 kW + 4kW | 175000Rs+65000Rs=240000Rs | 6h*19kW = 114 kWh | 473 Rs |

Another and very effective way to reduce O&M costs would be using of solar panels. Solar panels can have a guarantee of 20 years and the O&M costs are nearly minimal but as the cost of one panel 45 000 Rs and about 24 panels would be needed for Makaimro LWSS (PSU, 2011), the investment cost would result in a high number. Due to the per capita investment cost limitation of 7500 Rs/person in the RWSSP-WN criteria, solar panels were not considered during the design phase of Makaimro LWSS but have been successfully implemented in some other schemes of the project. As the regular O&M costs are very small, a solution could be to take a loan and collect a bigger share of the investment costs from the community as a regular water tariff.

According to Word Bank (Churchill et al, 1987), any level of service below individual household connections actually represents a very expensive water supply for its beneficiaries because people are much less efficient carriers of waters than pipes. It can be asked if there was any reason for not having household connections in the scheme design even if labour is cheap in Nepal. However, the investment cost of the network would be more. Household connections could be equipped with water meters and encourage for economical use of water. On the other hand, the meters would enable the poor people to use a minimal amount of water and have a small water bill whereas people who are prosperous or able and willing to create income with help of the water could use more water and pay more.

### 5.4.5 Water quality

The water quality was not tested during the planning phase due to lack of equipment. Later, before the start of construction works the water quality of the sources was tested by the service provider. It was done 23.4.2011 using a ENPHO field test kit which has been recently introduced under RWSSP-WN program in all 9 districts. Despite its limitations in accuracy the field test kit is an affordable and practical water quality testing method in Nepal, where most suitable water laboratories are located in Kathmandu. Water quality testing in Kathmandu is expensive and geographically difficult because to conduct full analysis, the samples should reach the laboratory in 6 hours from the time of taking samples and there are other precautions to be done to get the appropriate testing results (PSU, 2011).

According to the field test, the water of the main source Makaimro fulfilled all National Drinking Water Quality Standards (NDWQS) and World Health Organization (WHO) guideline values (Table 16). The primary source is located on a small hill and therefore

the storm water passes it from both sides and can not pollute it easily. The secondary source Dharapani is located in the lower part of a wall-like rock formation and coli bacteria contamination was observed. The source is likely to have been contaminated by cattle or wild animals above the source. The best way to eliminate the problem would be to construct a fence around the source and start to treat the water if the fence does not help in a few months.

**Table 16. Water quality of the springs Makaimro and Dharpani.**

| Indicator | Unit | WHO GV | NDWQS | Makaimro | Dharapani |
|---|---|---|---|---|---|
| Temperature | Celcius | - | - | 19.0 | 19.0 |
| pH | - | 6.5-8.5 | 6.5-8.5 | 7.5 | 6.5 |
| CaCO3 | mg/l | 500 | 500 | 104 | 0.88 |
| Chloride (Cl-) | mg/l | 250 | 250 | 27.44 | 27.44 |
| Ammonia | mg/l | 1,5 | 1.5 | 1 | 1 |
| Nitrate | mg/l | 50 | 50 | 10 | 0 |
| Free residual chlorine | mg/l | 0.1-0.2 | 0.5 | not | not |
| Phosphorus | mg/l | - | - | 0.05 | 0.05 |
| Iron (Fe-3) | mg/l | 0.3 | 0.3 | 0 | 0 |
| Total coliform | Presence/Absence | 0 | 0 | Absence | **Presence** |

*Source: Field test results done by Service Provider using a ENPHO kit on 23.4.2011*

According to key informant interviews (KII, 2011) and focus group discussions (FGD, 2011) the people of Thaprek-7 (upstream settlement of the source) are very committed to this scheme and will understand to keep their cattle away. Also without cattle or the coli form observation in the secondary source, wild animals are always risky and fencing the intakes would be useful in the long run. Because the location of the springs is so far away from people and difficult to access, the key informants (KII, 2011) of WUSC and political parties did not see current demand for source protection but were ready to do everything necessary if needed.

## *5.5 Long-term sustainability of the scheme*

The design period of Makaimro lift water supply scheme is 20 years (P.U.R.D, 2011) whereas the design water quantity is 30 lpcd with a population growth rate of 1.62%. The key informants mentioned (KII, 2011) that the population is likely to increase not only because of birth rate but because of remigration of people who migrated out of their homes to find better facilities – especially water. If the population growth is higher, the availability of water quantity will run out. If the population growth is smaller or negative because of urbanization or migration to other rural areas, it might be difficult to raise enough money for O&M. If the people can afford bigger costs, they might be interested about having more water per capita and more sources could be added. The present yields of the sources can not be guaranteed to remain the same in future due to climate change effect which is apparent as in other parts of the country.

The network of the scheme has capacity to deliver multiple quantities of water. According to the key informant interviews (KII, 2011) there are many additional sources close to Makaimro and it is easy to increase the pumping quantity and build household connections if finance is available and the households can raise enough money for O&M

costs. It is sustainable that the technical circumstances are suitable for progress. According to the guess of the informants, this extension could be possible in 8-10 years. It seems like the key informants thought that private connections are too expensive. This kind of things should be calculated and the households asked about their willingness to pay for them before a design is finished. To assume that the households are not able or willing to pay for something is not enough. According to PSU (2011), the investment cost of a household connection including water meter is 2000-3000 Rs and the households must cover the cost themselves whenever the household connections are proposed regarding the schemes of the project. It is hydraulically possible to add household connections to a part of the households without changes in the current network design.

A study from 2005 (NEWAH, 2005) concluded that 20% out of 6278 water points visited in Nepal were not functioning at all, 50% required attention and only 30% were functioning to design. Makaimro lift water supply scheme is technically and economically demanding and requires regular operation and maintenance. If the households do not raise sufficient tariffs and the WUSC does not manage technical and economic challenges, it may not function to the design period. So far the WUSC members and political leaders (KII, 2011) were very eager to solve all kind of economic problems. First of all they were planning to take a temporary loan to cover the up-front cash of the households which can or will not pay in time. For covering the labour contribution of the households which can or will not contribute, the remaining households will be requested many times and if this does not help, the other ones will work more or manpower will be hired form outside the VDC. For the unexpected O&M costs they were planning to create a big fund with money from charity organizations and from people who used to live in Thaprek and are now living in Europe and want to help their village. The interest rate of this fund will be used for regular O&M and the rest will be saved for unexpected expenses.

According to Adhikari and Bhattarai (2010), sustainability of water and sanitation can be divided to technical, institutional, financial and social/environmental dimensions. Social dimensions like commitment of pump operators, conflicts on tap stands and distribution of water, conflicts within the whole community and conflicts inside the WUSC can be mastered with willingness. All technical challenges can be solved if money and consultancy is available, but the financial dimension like large natural hazards or difficulties to pay tariff when being extremely poor are not in the hand of the community only. Excluding the transmission pipeline in the steep landscape, the environmental impacts of the constructions are small. The use of saved time and potential higher living standard can however change the environment. Also daily energy consumption is impacting the environment indirectly as the electricity is mainly produced by hydropower which has impacts on the utilized river.

# 6 CONCLUSIONS

In this chapter, the reported strengths and weaknesses of Makaimro lift water supply scheme are concluded and summarized. Thereafter, the overall impression and forecast of the author is given.

## *6.1 Strengths and opportunities*

- WUSC and the personnel of the service provider were committed, active and eager towards the successful implementation of the scheme;
- Ward no. 7 was well informed and willing to contribute which proved the potential of the community;
- People were interested about the scheme and the meetings;
- Construction works progressed rapidly with significant community participation;
- The estimated saved time of 2h/HH/day was considerable and the scheme is demand driven as the existing hardship was considerable;
- The estimated use of saved time was very supportive for income generating activities;
- Only one interviewed household said that it can not pay the regular tariff, while other households were ready to increase their income or reduce expenditure, which is a good sign of willingness;
- The community was cohesive as no conflicts about the proposed source came up;
- Positive health effects are obvious even if not noticed by the majority of the households;
- If the water supply and saved time will strengthen the economy and therefore capability to pay, it is possible to increase the quantity of supplied water using additional sources with increased pumping hours and create even more income opportunities and
- 1/3 of the water fetching trips were conducted by males.

## *6.2 Weaknesses and threats*

- The technical design is not cost-effective and was not designed in full involvement of the community;
- In some clusters, the scheme information did not reach the household level before the agreement and the people were not involved from the beginning which might have caused permanent harm to the commitment and may decrease ownership towards the scheme;
- Therefore, a big part of the population does not know what is designed and might have expected for example more water, lower price or household connections;
- 38% of the households would like to have more than the designed 30 lpcd of water and 48% were expecting irrigation as a benefit of the scheme;
- Therefore, the community might not be satisfied with the water quantity or there may be conflict of interest;

- The disputes on existing sources used by the community which were reported by 20% of the households might shift to the public tap stands if the water demand exceeds the supply;
- Successful labour contribution from households outside ward no. 7 is not guaranteed and many potential young workers have migrated;
- Only 23% of the households said that they have enough money to cover the tariff without increasing income or reducing expenditure which indicates that 200 Rs/month is much for majority of the households;
- Therefore, raising enough money from the households might be demanding despite the strong willingness;
- The institutional management might become demanding for WUSC if they do not get technical consulting from outside;
- Many people do not yet have skills to do income generating activities effectively or lack linkages with other related organizations/financial institutions and
- The pumps and accessories will get damaged sooner or later and are expensive to repair or replace.

## *6.3 Overall impression and forecast*

The community was not involved enough from the beginning and the scheme was not properly designed in due consultation with them. No technical options with cost implications and alternatives were properly discussed with the community to make better choice. Hence, the technical design was not fully cost-effective and the community will suffer from that in their monthly water tariff. As the community is not extremely poor, household connections might have been an affordable option for many households. The construction works will be finished somehow even if not all households can or will contribute. WUSC will be able to solve most problems if they can keep their enthusiasm they have now and get economic and technical consulting from outside, preferably from the district. The present water supply situation is so troublesome that most of the ones who were not committed yet will have willingness to pay the up-front cash and do their labour days when they see the success of construction works and gain the trust.

After finishing the scheme, the role of IG activities, price and availability of electricity and breakdown frequency of pumps will be significant. If too many households can not increase their income with help of increased amount of water and time saved or do not want to pay, big scale cross-subsidization will be difficult to arrange in a way which pleases the most. The limited water quantity and availability hours might come as a surprise to the community and create disputes. If the community can not afford the costs despite willingness, the government should subsidize the scheme because water supply is a basic human right.

# 7 RECOMMENDATIONS

In this chapter, the recommendations about scheme implementation in general and about electrical lifting scheme implementation and Makaimro LWSS in particular are presented. They are subjective opinions of the author based on the field work, literature review and discussions with specialists.

## *7.1 Scheme implementation in general*

### 7.1.1 Social

- The people might be eager to get the water quickly but to find out the best and most sustainable solution for the community, it is better to give sufficient preparation time for the design and agreement;
- It should be found out if there has been failed schemes and take that to consideration when involving and convincing the people;
- The public hearing could be supported and briefed by smaller cluster or ward meetings that are close to the people, do not take much time and create the interest to attend the public hearing. It is also easier for shy persons to talk in a small meeting where other participants are familiar;
- Not only the most eager ones but a fixed part (for example 2/3) of all households should agree with the contract and know and understand their decision;
- Therefore, the people should be well aware of the selected scheme:
    - Advantages: health benefits, saved time, comfort
    - Possible disadvantages: limited hours of water, absence of household connections, needed contribution during the construction phase and tariff policy;
- Information plan should be an obligatory part of the scheme planning and all houses should be informed about major steps during planning, implementation and use of the scheme. It takes too much time for the WUSC members to go from house to house;
- One or more cluster messenger chosen by the cluster could be mobilized to distribute the scheme information to the households. He/she could be a link between WUSC and the households and pass on money and information and
- The information could be distributed using participatory, exhilarating methods like in the triggering works of the WASH planning and remember that improved water supply is something completely new for most of the people and the information can not be adopted at once

### 7.1.2 Economic

- In co-operation between outsiders and beneficiaries, it could be viable to make a pre-estimate of the economic potential of the saved time and increased water amount;
- The service provider unit should find out which income generating activities are suitable and scopeful in the area and give the people education about them to reach a maximum level of households which can pay the full water tariff and support them to establish linkages with related organizations for getting financial, technical and other support;
- With outside support and specific criteria, WUSC could identify the poorest households and give discount for them instead of having the options of no or full regular tariff and
- The decisions and economic documents of WUSC should be visible on a notice board.

### 7.1.3 Technical

- The exploration of all alternative water supply options should be an organized process where the outsiders have the technical and economic knowledge whereas the beneficiaries are specialists of their VDC, their lives, their affordability and their needs;
- There should be trust and resources to let the community choose the best scheme design with proper information and understanding;
- The scheme design should not be accepted before the structures are cost-effective, O&M costs are estimated and optimized as well as water quality is tested, there is a plan for source protection and a geological survey around the source and other major structures is conducted and reported;
- The household opinion about private connections and willingness to pay for them should be taken into consideration in the design phase because the investment and O&M costs might be less than the advantages of the saved time and comfort;
- The summary of the design estimates (major highlights) regarding the total scheme cost, number of structures to be built and their costs, community contribution (cash and kind), O&M requirements, payment schedules and amount etc. should be translated into Nepali and provided to the WUSC for maintaining better transparency;
- Decisions about technical options for the excluded clusters, if any, should be made in the planning and designing phase in co-operation between all stakeholders and
- The household opinion about private connections and willingness to pay for them should be taken into consideration in the design phase because the investment and O&M costs might be less than the advantages of the saved time and comfort.

## *7.2 Electrical lifting schemes*

- Because of high initial investment cost and per capita cost limitation criteria (7500 Rs) of RWSSP-WN, solar lifting was not possible in Thaprek. However, the option to have solar lifting should be taken seriously whenever possible because for the time being, the solar panels are guaranteed for 20 years and O&M costs are minimal which makes it an economically and environmentally sustainable option;
- As the O&M costs for solar lifting are minimal, the regular water tariff could instead focus on paying back a bigger part of the investment costs;
- Whenever electrical lifting proposed and especially when load shedding is a risk, the pumping capacity should be optimized to be operated with short pumping hours and big pumping capacities;
- Experiences from other electrical lifting schemes should be gathered and shared with all WUSCs (for example about insurance, water tariffs and operational modalities);
- The structures should be insured against landslides, earthquakes and flooding and the pumps against lightning if within the affordability;
- The pump operators should be very committed as well as professional and stop pumping and unplug electricity when there is risk for lightning and
- A cheaper electricity price should be applied from the electricity authority if the water is used for irrigation or agriculture.

## *7.3 Makaimro LWSS*

- Include the households in the cluster of Chiti Swara or provide another improved option for them;
- Initially, water meters should be installed on the public tap stands;
- According to the HH survey results, 73% of the respondents do not want that income influences the water tariff and 60% want to pay according to the used amount of water. Therefore, household connections and water meters in Makaimro LWSS would minimize the fetching time, decrease need of cross-subsidization, keep water using conflicts inside the households and encourage to use water economically and
- The water tariff should be inspected regularly.

## *7.4 Need for further research*

- Post-implementation research for example half year after Makaimro lifting scheme is finished:
    - <u>Benefit monitoring and evaluation study</u>
        - Fulfilment of labour contribution, up-front cash contribution and regular water tariff contribution;
        - Reasons for not paying (willingness or affordability);

        - Do the paying households prefer the present water situation compared to the previous;
        - What could have done better during and after scheme implementation from WUSC and HH point of view and
        - O&M status and experiences.
    - Impact study
        - How has the saved time been used and what has been the economic power and
        - What have been the effects on health.
- Comparative study of water tariff policies in rural Nepal: criteria, collecting method and satisfaction of the users;
- Feasibility study of solar lift water supply schemes;
- Possibility to finance solar lifting schemes on loan basis and
- Is up-front cash a good way to make the people committed.

# REFERENCES

## *Literature*


Adhikari K. P., Kunwar L. S., MacDonald V & Paudel M. (2006). *Qualitative Research for a Zinc Treatment Program in Nepal: Findings and Recommendations. Bethesda, MD: The Social Marketing Plus for Diarrheal Disease Control: Point-of-Use Water Disinfection and Zinc Treatment (POUZN) Project*. AbtAssociates Inc.

Adhikari B. K., Bhattarai, S. (2010). *Long term sustainability monitoring – WaterAid's experience in Nepal*. WaterAid in Nepal and ICON.

ADB = Asian Development Bank. (1999). *Handbook for the Economic Analysis of Water Supply*. Available at: http://www.adb.org/Documents/Handbooks/Water_Supply_Projects/default.asp

Castillo, J. J. (2009). *Stratified Sampling Methods. Experiment Resources*. Available at: http://www.experiment-resources.com/stratified-sampling.html

Churchill A.A. et al. (1987). *Rural Water Supply and Sanitation – Time for a Change* World Bank Discussion Paper No.18 (World Bank)

Dahal R., Ban J. K., Dwa N., Shrestha R. S. and Makaju S. *Rainwater harvesting (RWH) in Nepal. December 2010. A case study of social acceptability and performance evaluation of RWH schemes implemented in Syangja and Tanahun districts.* RWSSP-WN and Tribhuwan University. Available at: http://www.rwsspwn.org.np/reports-and-documents/Arsenic%20Research%20Report%20Final%2024.1.11/RWH%20study/Latest%20FINALLL.pdf

DDC = District Development Committee, Tanahun. 2011. *Cost estimate of Makaimro LFSS*.

DDC, Tanahun. 2010. *WASH plan of Thaprek VDC*. Available in Nepali only.

Gunatilake H., Yang J-C., Pattanyak S. & Choe K. A. (2006). *Good Practices for Estimating Reliable Willingness-to-Pay Values in the Water Supply and Sanitation Sector*. Asian Development Bank. Available at: http://www.adb.org/Documents/ERD/Technical_Notes/TN023.pdf

Law Management Society. (1999). *Local Self-Governance Act, 1999*. Law Management Society, Kathmandu.

Marlow, A. & Sherry, S. T. (1999). *Getting the Lay of the Land On Health: A Guide for Using Interviews to Gather Information (Key Informant Interviews)*. Published by The Access Project.

MPE = Ministry of Population and Environment. (1997). *Environmental Protection Act 1997*.

MPPW = Ministry of Physical Planning and Works. (2009). *Rural Water Supply and Sanitation National Policy* and *Rural Water Supply and Sanitation Strategy.* Framework available at: http://www.rwsspwn.org.np/reports-and-documents/4/1.pdf

NEA = Nepal Electricity Authority. (2010). *A year in review, fiscal year 2009/2010*. Available at: http://www.nea.org.np//reports/annualReports/BvTeH9hxFHAnnualReport2010.pdf

NEWAH = Nepal Water for Health. (2005). *A report on NEWAH Looking Back Study (LBS)*. Nepal Water for Health, Kathmandu, Nepal.

NMIP/DWSS = National Management Information Section/Department of Water Supply and Severage. (2010). *A Survey Report on Nation-Wide Coverage and Functionality Status of Water Supply and Sanitation*. Kathmandu.

OECD = Organisation for Economic Cooperation and Development. (2009). *Managing water for all – An OECD perspective on pricing and financing. Key messages for policy makers.* Available at: http://www.oecd.org/dataoecd/53/34/42350563.pdf.

P.U.R.D. Consultants Nepal (P) Ltd. (2011). *Final Pumping Station Design of Makaimro Water Supply Project Thaprek, Tanahun*

Redhouse D., Robersts P. & Tukai R. (2004). *Everyone's a Winner? Economic Valuation of Water Projects.* London: Water Aid. Available at: http://www.wateraid.org/documents/every_ones_a_winner__economic_valuation.pdf. Referred 30.5.2011.

RWSSFB = Rural Water Supply and Sanitation Fund Board. (2010). *Implementation Progress Report. 1st Trimester FY 2010/11*.

VDC = Village Development Committee Thaprek. (2010). *WASH plan.*

WECS = Water and Energy Comission Secretariat. (2002). *Water Resources Strategy Nepal*. Kathmandu.

World Health Organization (WHO). 2004., *Facts and figures: Water, sanitation and hygiene links to health* Available at: http://www.who.int/water_sanitation_health/publications/factsfigures04/en/

## *Other sources of information*

Baseline Survey about water, sanitation, health and hygiene. 2010. Conducted by RWSSP-WN as a part of preliminary WASH activities. The statistics are taken from the 229 beneficiary households which could be identified out of 265.

FGC = Focus Group Discussions. Two focus group discussions with women on 8.5.2011 and 9.5.2011.

HH Survey = Household Survey about Makaimro Lift Water Supply Scheme in 40 households between 29.4.2011-6.5.2011.

KII = Key Informant Interviews with 10 teachers, 3 political leaders and 5 Water Users and Sanitation Committee (WUSC) members 28.4.2011 and 7.5.2011-9.5.2011.

PSU = Project Support Unit of RWSSP-WN. This refers to estimations and comments of the specialists of RWSSP-WN.

Softwel. A design program used for planning of lifting schemes.

Tap stand group list 2011. Conducted by WUSC during the tap stand group formation.

# ANNEX 1. Conducted research activities

**Table 17. Schedule of conducted field work activities.**

| Day | Activities |
|---|---|
| 28.4.2011 | Group KII with 10 teachers |
| 29.4.2011 | 5 HH surveys in ward no 7 |
| 30.4.2011 | 6 HH surveys in ward no 7 |
| 1.5.2011 | 1 HH survey in ward no 6, 4 HH surveys in ward no 5 |
| 2.5.2011 | 6 HH surveys in ward no 5 |
| 3.5.2011 | 3 HH surveys in ward no 5 |
| 4.5.2011 | 3 HH surveys in ward no 9, 3 HH surveys in ward no 8 |
| 5.5.2011 | 2 HH surveys in ward no 8, observation walk to the source |
| 6.5.2011 | 7 HH surveys in ward no 8 |
| 7.5.2011 | Group KII with 2 WUSC members and 2 political leaders |
| 8.5.2011 | Individual KIIs with 2 WUSC members. FGD in ward no 7 |
| 9.5.2011 | Group KII with 1 political leader and one WUSC member. FGD in ward no 5. Individual KII with a WUSC member |

**Table 18. Schedule of other activities outside the office.**

| Day | Activities |
|---|---|
| 2.4.2011 | Visiting the public hearing of Makaimro LFSS |
| 6.4.2011 | Visiting the public hearing of Alamdevi LFSS in Syanja |
| 25.4.2011 | Visiting DDC Tanahun and testing of the questionnaire in Ghansikuwa VDC |
| 5.6.2011 | Monitoring the construction works and institutional status of WUSC, conducted by 2 specialists from the PSU of RWSSP-WN |

**Table 19. Final schedule of the whole research process.**

| Description of Activities | Week (year 2011 a.D.) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | March | April | | | | May | | | | June | | | | |
| | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| Writing and getting comments for the research proposal | | | | | | | | | | | | | | |
| Visiting Makaimro and Alamdevi, choosing one of them | | | | | | | | | | | | | | |
| Comments on proposal and questionnaires, finishing them | | | | | | | | | | | | | | |
| Field work | | | | | | | | | | | | | | |
| Data analysis | | | | | | | | | | | | | | |
| Draft report preparation | | | | | | | | | | | | | | |
| Final comments, presentation and submission | | | | | | | | | | | | | | |

# ANNEX 2. COST SUMMARY

District Development Committee,Tanahun

Scheme Name: Makaimro WS Scheme

Scheme Code: 04004607pup1

VDC: Thaprek WN: 7 HH: 265

Beneficiary Clusters: Thaprek, 5-9 Present Population: 1685

Scheme Cost Summary

| *SN* | *Description* | *Quantity* | *Unit* | *Amount(Rs)* | *Remarks* |
|---|---|---|---|---|---|
| 1 | Local Materials | 179.94 | | 137 967.43 | |
| 2 | Non Local materials | 2123.41 | | 493 417.65 | |
| 3 | LABOUR | 8144.75 | | 2 493 588.48 | |
| | 3.1 Skilled Labour | 348.4 | | 153 294.37 | |
| | 3.2 Unskilled Labour | 7796.36 | | 2 340 294.12 | |
| 4 | **Cost of Pipes** | | | | |
| | 4.1 GI PIPE | 556.28 | m | 195 826.19 | |
| | 4.2 HDPE PIPE | 17510.19 | m | 1 106 542.79 | |
| 5 | Fittings | 1020 | Kg | 446 068.00 | |
| 6 | Tools | 169.45 | Kg | 70 877.00 | |
| 7 | Tools for pipe line jointing | 0 | days | 0 | |
| 8 | Tools,Plants and Contigencies | | % | 2 026.09 | |
| 9 | Miscellaneous | | | 161 065.25 | |
| 10 | **Transportation cost** | | | | |
| | 10.1 Convenient materials | 25834.82 | Kg | 210 812.11 | |
| | 10.2 Inconvenient materials | 0 | Kg | 0.00 | |
| | 10.3 Pipes | 6052.33 | Kg | 71 860.32 | |
| | **Total (A)** | | | **5 390 051.30** | |
| | **Cost of taxable materials(nonlocal materials,pipes,fittings,tools)** | | | **2 475 822.96** | |
| | VAT @ of 13% | | | 321 856.98 | |
| | Cost of Educational Awareness (B) | | | 27 000.00 | |
| | C.Total (A+B) | | | 5 738 908.29 | |
| | Contingencies @ 2.5% of C | | | 143 472.71 | |
| | Overhead @ 0% of C | | | 0.00 | |

| | | | | | |
|---|---|---|---|---|---|
| | **Grand total of Distribution Line (I)** | | | **5 882 380.99** | |
| | **Grand total of Transmission Line (II)** | Refer Final report of Pumping Station Design of Makaimro Water Supply Project prepared by PURD Consultants for details | | **5 944 928.00** | Refer Final report of Pumping Station Design of Makaimro Water Supply Project prepared by PURD Consultants for details |
| | **Grand Total Cost of whole Project (I+II)** | | | **11 827 308.99** | |
| **Breakdown of cost among the stakeholders** | | | | | |
| | | | | | |
| ***SN*** | ***Name of stakeholder*** | ***Amount(Rs)*** | | | |
| 1 | Community Contribution in Total | 3 075 100.34 | 26.00% | | |
| | 1.1 Community Contribution in Cash | 118 273.09 | 1% | | |
| | 1.2 Community Contribution in Kind | 2 956 827.25 | 25% | | |
| 2 | Contribution of VDC | 591 365.45 | 5% | | |
| 3 | DDC Matching Cost | 354 819.27 | 3.00% | | |
| 4 | Contribution From DDF | 7 806 023.93 | 66.00% | | |
| | 4.1 GON | 2 575 987.90 | 33% of DDF | | |
| | 4.2 GOF | 5 230 036.04 | 67% of DDF | | |
| **5** | **Total cost** | **11 827 309.0** | | | |
| | | | | | |
| 6 | Present per capita cost | **7 019.17** | | | |
| | | | | | |
| 8 | 2% of Estimated Cost for Operation & Maintenance | 236 546.18 | 2% | | |

# ANNEX 3. HH SURVEY QUESTIONNAIRE

## Socio-economic Feasibility Study of Makaimro Lift Water Supply Scheme in Tanahun District of Nepal

## HOUSEHOLD SURVEY QUESTIONNAIRE

Namaste! We are from RWSSP-WN, the project which now supports to implement Makaimro water supply for your community through a lifting system. Many other communities in rural Nepal are still without water supply and waiting for their own schemes. We are asking your opinions on Makaimro lift water supply scheme to make the other schemes as feasible as possible from the villager's point of view in terms of social and economic affordability and willingness. This research is also a part of the studies of Laura Aaltonen from Finland. Your answers will be analyzed anonymously and the information provided by you will be kept confidential. Thank you for your precious time.

Name of interviewer_____ Date: _____
District _____ VDC_____
Ward No_____ Cluster_____ Tap No ____
Name of interviewee_____ M/F_____
Interviewee's relation with the household owner_____
Name of HH owner _____
Caste of HH owner: Dalit/Adibasi-Janjati/Brahmin-Chhetri/Muslim/Other, specify_____

Family

| Members | Nos. |
|---|---|
| Women (18 years and older) | |
| Girls (< 18 years) | |
| Men (18 years and older) | |
| Boys (< 18 years) | |
| Total | |

Position of HH in WUSC: ☐Chair ☐ Secretary ☐Treasurer ☐ Member ☐ No (user only)
Yearly income:_____

# 1 Present water use and fetching

***1.1 Please answer the following questions about your main water source during wet season and your main water source during dry season. If the main source is same during the whole year, please describe one source only.***

| **Description** | **Primary (Wet season)** | **Secondary (Dry season)** |
|---|---|---|
| **1.1.1** Source Name | | |
| **1.1.2** Source type (RWH, stream, spring, kuwa, pond, tap, other)? | | |
| **1.1.3** Water availability in the source (months/year) | | |
| **1.1.4** For how many months per year do you use the source? | | |
| **1.1.5** When the source is usable, for how many hours/day can water be taken from the source? | | |
| **1.1.6** How many minutes does it take to fetch one round trip water? | | |
| **1.1.7** How many person trips/day are carried out by: | | |

| | | |
|---|---|---|
| Women (18 years and older)? | | |
| Men (18 years and older)? | | |
| Girls (<18)? | | |
| Boys (<18)? | | |
| **1.1.8** Average capacity of vessel(s) used to fetch water per trip (in liters)? | | |
| **1.1.9** What do you say about the water quality (checkmark)? | | |
| *good, nothing to complain* | | |
| *taste problems* | | |
| *odor problems* | | |
| *temperature problems* | | |
| *turbidity problems* | | |
| *other problems, specify* | | |
| **1.1.10** Do you have problems with the accessibility? | | |
| *no problems* | | |
| *long distance* | | |
| *long queue* | | |
| *river crossing* | | |
| *landslide crossing* | | |
| *forest crossing* | | |
| *steep or slippery path* | | |
| *disputes* | | |
| *others, specify* | | |
| **1.1.11** For what do you use the fetched water (checkmark)? | | |
| *drinking* | | |
| *cooking* | | |
| *washing laundry* | | |
| *washing utensils* | | |
| *bathing* | | |
| *hygiene (hand washing and tooth brushing)* | | |
| *toilet* | | |
| *livestock* | | |
| *kitchen garden* | | |
| *others, specify* | | |

## *1.2 General*

**1.2.1** During the last year, for how many days did people in your household suffer from diarrhoea? _____ persons for _____ days

**1.2.2** During the last year, how much money did people in your household use for medical treatment because of diarrhoea? _____ Rs/HH

**1.2.3** How troublesome do you find the water supply situation in your household on scale of 1-3 (1 = no troubles, 2= small troubles, 3 = big troubles)? _____

**1.2.4** How much money does your household spend for water per month? _____Rs/HH

# 2 Knowledge of the scheme and willingness to contribute

## *2.1 Willingness to contribute for cash & kind before explaining the costs*

**2.1.1** Are you willing to pay something for improved water supply service? ☐ Yes ☐ No

**2.1.2** How much up-front cash are you willing to pay for the investments, the operation and the maintenance of the scheme? _____ Rs/HH

**2.1.3** Are you willing to pay the up-front cash for investments and O&M before the scheme is finished? ☐ Yes ☐ No, reason:_____

**2.1.4** How many labor days are you willing to contribute for the construction works? _____ days/HH

**2.1.5** How much are you willing to pay regularly for the regular and future operation and maintenance of the scheme? ____Rs/month

## *2.2 Knowledge of the scheme*

**2.2.1** Do you know what kind of contribution is expected from household side? (Marked by the interviewer if mentioned: ☐ investment cash ☐ up-front cash for O&M ☐ labour contribution ☐ land provision ☐ regular cash/kind for O&M ☐ all of the above ☐ others_____)

**2.2.2** What kind of benefits do you expect from this scheme? (Marked by the interviewer if mentioned: ☐ comfort ☐ health ☐ time saving ☐ economic benefits ☐ social harmonization ☐ reduction in water disputes at home ☐ reduction in water disputes at water source ☐ all of the above ☐ others_____)

**2.2.3** Can you tell me the name of the place where the distribution chamber of this scheme is located? ☐ Yes ☐ No. If Yes, name of the place_____

*(The source location is explained by the interviewer. If the interviewee now knows the location, the following will be asked:)*

**2.2.4** Do you think that the water quality of the source is good for this scheme? ☐ Yes ☐ No ☐ I do not know.

**2.2.5** Do you think that the water quantity/yield of the source is enough? ☐ Yes ☐ No ☐ I do not know.

**2.2.6** In your opinion, is there an alternative source better than the proposed one? ☐ No ☐ Yes, explain which source and why_____

## *2.3 Willingness to contribute for cash & kind when explaining the exact costs*

**2.3.1** Is your household willing to contribute for the following:

| FACTOR | Yes | No | If no, how much then? |
|---|---|---|---|
| Your household is asked for **labour contribution of 38 days**. It consists of digging, pipe laying, concrete and masonry works, material collection and material transportation. Are you willing to contribute? | | | |
| Your household is asked for **up-front cash contribution of 1340 Rs**. It consists of 450 Rs for investments and 890 Rs for up-front operation & maintenance. Are you willing to contribute? | | | |
| Your household is asked for **regular cash contribution of 200 Rs per month**. It is needed to cover electricity costs, spare parts for minor and major repairs and salaries for operation and maintenance workers. Are you willing to contribute? | | | |

## *2.4 Willingness to contribute by giving private land for structures*

**2.4.1** Do you know, if some structures are proposed to be built on your land or not? ☐ I do not know ☐ No, they are not proposed ☐ Yes, they are proposed. If yes, how much private land are you willing to give for structures?

| Demand | Proposed (ropani) | Willing to give (ropani) | Reasons |
|---|---|---|---|
| Wastewater and overflow water | | | |
| Reservoir tank | | | |
| Distribution chamber | | | |
| Public tap stand post | | | |
| Pipeline laying | | | |
| Others, specify_____ | | | |

**2.4.2** If structures are proposed to be on your land, have you done or will you do a written agreement about the use with Water Users and Sanitation Committee? ☐ Yes ☐ No

## *2.5 Contribution in scheme planning and implementation*

**2.5.1** What was your contribution in the following meetings?

| **Meeting** | **Who attended from your household?** | **If no one from your household attended the meeting, what was the reason?** |
|---|---|---|
| *Public hearing* | _____ Males<br>_____ Females | ☐ No time<br>☐ No interest<br>☐ Did not know about the meeting<br>☐ Other_____ |
| *Tap stand group formation* | _____ Males<br>_____ Females | ☐ No time<br>☐ No interest<br>☐ Did not know about the meeting<br>☐ Other_____ |
| *Action planning* | _____ Males<br>_____ Females | ☐ No time<br>☐ No interest<br>☐ Did not know about the meeting<br>☐ Other_____ |
| *Other*_____ | _____ Males<br>_____ Females | ☐ No time<br>☐ No interest<br>☐ Did not know about the meeting<br>☐ Other_____ |

**2.5.2** Has your household been asked about opinions/ideas when designing this scheme? ☐ Yes ☐ No

**2.5.3** What has been asked (for example tap locations)?_____

**2.5.4** Do you know where the nearest tap will be?
☐ Yes ☐ No. If no, what are the reasons?_____

**2.5.5** If you know where the nearest tap will be, does the location satisfy you?
☐ Yes ☐ No

**2.5.6** The scheme is designed to cover a daily per capita water demand of 30 liters. Do you think it is enough for your household? ☐ Yes ☐ No

**2.5.7** Do you think that you have got enough information on this scheme? ☐ Yes ☐ No

**2.5.8** If you do not have enough information, what would you like to know more?
_____

**2.5.9** How should the scheme information be distributed?_____

### *2.6 Regular monthly water tariff collection plan*

**2.6.1** Do you know who will decide the monthly water tariffs? (Marked by the interviewer: ☐ Yes, WUSC ☐ No/wrong answer)

**2.6.2** How do you think that the monthly water tariff should be decided in general?
☐ fixed tariff per household ☐ fixed tariff per person ☐ according to the used amount of water (measured with a water meter on the tap)

**2.6.3** How should the regular water tariffs be decided according to the income status?
☐ All households should pay the same
☐ The poor households should pay less and the wealthy households should pay more

**2.6.4** How are you going to cover the monthly water tariff?
☐ We have enough money ☐ We can not afford the tariff
☐ We will increase our income, how? _____
☐ We will reduce our expenditure, how? _____

## 3. Estimated use of saved time

**3.1** How do you plan to use the time saved, now that you do not have to fetch water from the source (rank the 5 most important uses)? *(The household will tell these five things by themselves and the interviewer will choose the right category).*

| **Task** | **Ranking** |
|---|---|
| Education | |
| Meeting friends and family | |
| Household work | |
| Taking care of children and aged | |
| Firewood collection | |
| Fodder collection | |
| Agriculture/livestock | |
| Private business (income generating activities) | |
| Labour work | |
| Other income generating activities | |
| Fetching water from other sources (not tap) | |
| Sleep/Rest | |
| Other, specify | |