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# Environmental Sustainability of Water Supply Systems Implemented at RWSSP-WN

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Helsinki Metropolia University of Applied Sciences

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<p>Many Nepalese rural communities are suffering from lack of safe drinking water. One of the reasons is that approximately one third to one half of all drinking water supply systems fail shortly after the construction. The main purpose of this thesis project was to analyze the environmental sustainability of rural water supply systems implemented by the Rural Water Supply and Sanitation Project in Western Nepal (RWSSP-WN). In addition, the thesis project also assessed the sustainability of the District Water Supply and Sanitation (DWSS) schemes from the institutional and financial point of view focusing on the organization and management capacity of the Water Users' and Sanitation Committees (WUSCs) in managing their schemes including their Operation and Maintenance (O&amp;M) management capacity to ensure the proper functionality and sustainability.</p> <p>This thesis is intended to fulfill the requirement for the partial compliance of Bachelor's in Environmental Engineering Degree Program at Helsinki Metropolia University of Applied Sciences, Finland. The thesis focuses primarily on the assignments carried out in the field, major observations noted, and interviews and discussions held with WUSCs and users/beneficiaries of each scheme visited. The data gathered during observations, discussions and interviews highlight the strength or major achievements of the schemes as well as the areas for improvement needed for the sustaina-</p>	

bility of the schemes.

Results show that most of the schemes studied have been affected by several water contaminants, mostly by *E-coli*, and some schemes also suffered from lime which caused a decrease in the sustainability of the schemes. Hence, it was concluded that to increase the sustainability of the schemes, the best available technology should be adopted to remove these water contaminants.

For this purpose, a study on best available technology to inactivate *E-coli* and remove lime, made, and several options were proposed to the RWSSP-WN project.

Keywords

RWSSP-WN, environmental sustainability, environmental assessment, BAT in water treatments, *E-coli*, lime.

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## ABBREVIATIONS

ADB	Asian Development Bank
BAT	Best Available Technology
CAP	Community Action Plan
CBO	Community Based Organisation
DDC	District Development Committee
DEO	District Education Office
DDF	District Development Fund
DOLIDAR	Department of Local Infrastructure Development and Agricultural Roads
DWSS	District Water Supply Systems
DTO	District Technical Office
EIA	Environmental Impact Assessment
FGD	Focus Group Discussion
FI	Financial Intermediary
GOF	Government of Finland
GON	Government of Nepal
HDP	High Density Polyethylene
IEE	Initial Environmental Examinations
IPPC	Integrated Pollution Prevention and Control
MDGs	Millennium Development Goals
MIS	Management Information System
MTR	Mid Term Review

MW	Maintenance Worker
PRA	Participatory Rural Appraisal
RWSSP-WN	Rural Water Supply and Sanitation Project - Western Nepal
RWH	Rain Water Harvesting
SI	Source Improvement
TYIP	Three Year Interim Plans
UN	United Nation
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
VDC	Village Development Committee
WASH	WASH Water Supply, Sanitation and Hygiene
WUSC	Water Users' and Sanitation Committee
WSP	Water Safety Plan
WB	World Bank

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## 1 Introduction

### 1.1 Background of the thesis

The Rural Water Supply and Sanitation Project in Western Nepal (RWSSP-WN) was started in 2008 and was supposed to be completed by 2012, but it was given a one – year extension. The project has involved cooperation between the Finnish government and the Nepalese government, and it has been operated by a Finnish company called Ramboll Finland Oy. Project covers 54 Village Development Committees of nine districts: Baglung, Kapilvastu, Myagdi, Nawalparasi, Parbat, Pyuthan, Rupandehi, Syanja and Tanahun (Figure 1). The total budget of this project is approximately 14.6 million euros, of which the Finnish government funds 66 % and the Nepalese government 23 %, respectively. The rest of the budget is funded by the user’s community and village development committees.

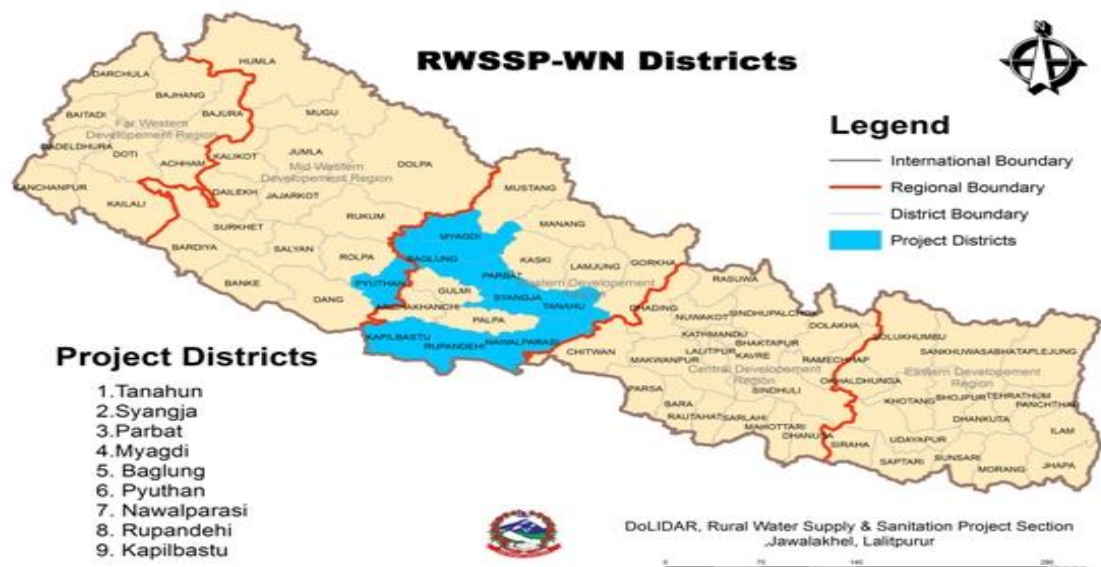


Figure 1. Project district of RWSSP-WN (Dolidar, 2012)

In general, the main purpose of this project is to increase the capacity of the peoples, who are politically, economically, socially, culturally and personally discriminated on the basis of the gender, caste, ethnicity, age, sexual orientation and religion. In addition,

the major focus of this project is to provide safe water for domestic use. It is implemented under GON rules and regulated especially by the Local Self Governance Act (LSGA 1999) and the Local Body Financial and Administrative Rules (LBFAR).

The project is expected to reach the following outcomes:

- provide the sustainable drinking water supply for all the community,
- empower the woman's capacity,
- improve the health, nutrition and hygiene of the people in program districts, particularly the poorest and excluded,
- reduce infant and maternal mortality rate and
- build up the capacity of local bodies to promote the WASH projects.

Viewed in terms of program components, the total physical targets of the project are domestic water supply to 80,000 people, hygiene and sanitation to 250,000 people, arsenic mitigation from water to 10,000 people, and environmental conservation, capacity building and income generation to 200,000 people (of which 52,000 is for environmental conservation).

The executing agencies of the project are the Ministry of Local Development (MLD) and its Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR), cooperating with District Development Committees (DDCs) and Village Development Committees (VDCs). The project is implemented and managed by the communities; the water supply scheme is the responsibility of the Water Users and Sanitation Committees (WUSCs) in the area, while the institutional/public sanitation is managed by the Institutional Management Committees (IMCs) or School Management Committees (SMCs) formed for each scheme. These committees are supported by the D-WASH Units formed under the District Technical Office (DTO) in each district and also by Service Providers (SPs), who are either institutional SPs or individual staff outsourced by the DDCs. RWSSP-WN also provides capacity building training and facilitation supports to DDC/DTO staff, including the SPs involved in programme implementation.

When it comes to technology, the domestic water supply schemes include gravity flow systems, source improvement (SI), ground water (hand pump, hand dug well), Multiple Use System (MUS) of water, Rain Water Harvesting (RWH), Lime Encrustation Mitigation and the electrical/solar powered lifting schemes (both in the hills and in Terai). The Water Safety Plan (WSP) and water quality improvement are also major concern areas of the project.

The project adopts planning, implementation, and consolidation phases tentatively of 6 - 9 months for implementing domestic water supply schemes (see Figure 2 for DWS Scheme implementation Steps/Process).

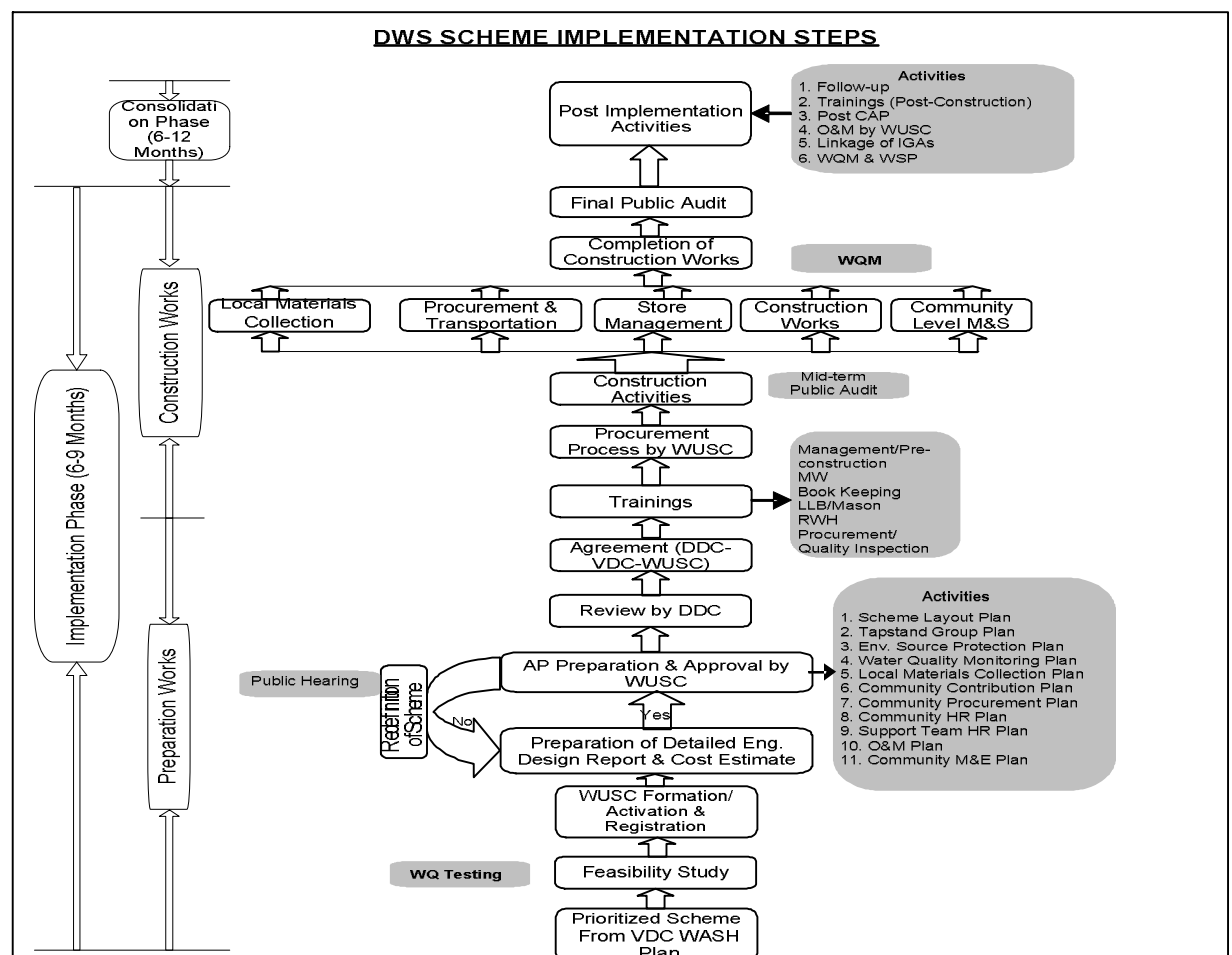


Figure 2. DWS Scheme Implementation Steps/Process

As can be seen in Figure 2, the prioritized schemes from the VDC WASH Plan are selected and included in the Annual Plan by each district for implementation. Then the feasibility study, detailed design estimate and other preparatory stage activities are conducted prior to the implementation of the scheme.

After the completion of a design estimate, the community with facilitation from Service Providers prepares Community Action Plan (CAP) regarding the implementation of the DWS schemes. This includes the following plans:

- Scheme Layout Plan
- Tap Stand Group Plan
- Environmental Source Protection Plan
- Water Quality Monitoring Plan
- Community Contribution Plan
- Local Materials Collection Plan
- Community Procurement Plan
- Community Human Resource (HR) Plan
- Service Providers' Human Resource Plan
- Operation and Maintenance Plan
- Community Monitoring and Evaluation Plan

Unlike the other plans, the environmental source protection plan is directly related to identifying the existing as well as possible threats in the source or catchment area and the possible mitigation measures to be adopted by the community people / users to protect it. During the preparation of this plan, the WUSC/ community and the SP hold discussions on the possible sources of pollution of the water source and the source protection activities. The SP also educates the community members regarding the dangers of deforestation and pollution by human activity in the source area or in the above catchment area. The community members should agree on actions that could be taken to ensure the protection of the source environment. Thus, the project has attempted to give due attention towards the environmental protection of the schemes and possible mitigation measures to be taken. Some other action plans, such as the scheme layout plan and the water quality monitoring plan also focus on the environmental sustainability of the schemes.

Till July 15, 2012, a total of 308 domestic water supply schemes have been completed, which includes 191 gravity flow (new), 29 gravity flow (rehab), 39 source improvement (SI), 34 Safe Tube Well (STW)/ Hand Dug Well (HDW) Rehabilitation, 11 Electrical/Solar lifting and 4 Rain Water Harvesting (RWH) schemes benefiting in total 14,592 households with 94,634 people. Table 1 presents the number of completed schemes by technology type and districts.

**Table 1. Number of completed Schemes by technology and by districts**

1 s. N.	District	No. of Schemes by Technology Type (Calculated based on MIS data)						
		Gravity New	Gravity Rehab	Source Improvement	Rain Water Harvesting	Electrical/Solar Lifting	Safe Tube Well /Hand Dug Well	Total
1	Baglung	16	2	1	2	0	0	21
2	Kapilvastu	0	0	0	0	0	20	20
3	Myagdi	39	3	12	0	0	0	54
4	Nawalparasi	3	6	0	0	1	11	21
5	Parbat	36	4	19	0	0	0	59
6	Pyuthan	37	3	1	1	0	0	42
7	Rupandehi	4	1	0	0	1	3	9
8	Syangja	25	5	0	1	4	0	35
9	Tanahun	31	5	6	0	5	0	47
	<b>Total</b>	<b>191</b>	<b>29</b>	<b>39</b>	<b>4</b>	<b>11</b>	<b>34</b>	<b>308</b>

<sup>1</sup> SN = sample number

## 1.2 Objective of the thesis

The main purpose of the thesis project was to study in environmental sustainability of water supply systems in Nepal implemented by RWSSP-WN. The focus was mainly on the removal of lime and coliform from water and on the environmental assessment of all selected schemes. In addition, the thesis project also aimed to analyze the overall sustainability of all selected schemes.

Specifically, the thesis project focused on the following areas:

- Catchment protection
- Water source/intake conservation
- Protection of water transmission main and distribution system
- Structures Protection - Protection of different structures such as intake, collection chamber, Distribution chamber, Reservoir Tanks, tap stands etc.
- Assessment of the existing as well as possible environmental threats and the protection measures taken
- Institutional capacity and operation and the maintenance system adopted by the committee

## 1.3 Scope of the thesis

The following will be the key areas of concern to meet the objectives of the thesis project:

- Assessment of the physical and functionality status of the system built, e.g. intake, transmission mains, reservoirs, distribution systems; tap stands, and other structures including service adequacy and reliability of the system



- Assessment of the existing or possible environmental threats (e.g. landslides, flooding, water logging, lightening/thundering, earthquake, coliform, lime etc.) and the protection/mitigation measures taken
- Determination of the BAT for the removal of coliform i.e. a technique that is more economic, easy to install and that involves much more appropriate technology than some other coliform removal technique and recommendation for the project
- Determination of the BAT for the removal of lime i.e. more economic and easy to install and that involves much more appropriate technology than some other lime removal technique and propose for the project
- Assessment of the overall sustainability of the schemes based on the sustainability indicators on environmental, institutional, financial, and technical aspects.
- Assessment of the possible threats of source pollution or depletion (if any) and the protection measures adopted or needed, including other water quality issues.
- Assessment of the institutional capacity of Water Users and Sanitation Committee (WUSC) and the community involvement in implementing or managing the schemes.

The thesis is based on both primary as well as secondary information. On the basis of the findings, checklists and questionnaires were prepared to obtain the necessary information through field study and also through observation.

#### **1.4 Sample size and selected schemes**

Out of the total of 308 completed schemes, 10 schemes were randomly selected for in-depth study the schemes selected covers different technological options and also different ecological features (Hill and Terai). Table 2 lists the schemes selected:

Table 2. Sample size and selected schemes

s.n 1.	District	VDC	Scheme Name	Ecology (Hill/Terai) and Scheme Type	H H s	Popula- tion	Major Caste/ethnic group
1.	Tanahun	Barbhan- jyang	Nabarung Devi	Hill / Electric Lifting; New double stage pumping	39 7	2375	Majority Ja- najati
2.		Barbhan- jyang	Chhatimane	Hill / Gravity- flow Rehabilita- tion	17 8	890	Majority Ja- najati
3.	Myagdi	Arman	Handebhir Krose	Hill / Gravity- flow, New	23	150	Majority Ja- najati / Dalits
4.		Bhakimlee	Jukepani Odare	Hill / Gravity- flow, New	18	114	Majority Ja- najati
5.	Baglung	Bihunkot	Jukepani	Hill / Gravity- flow, New	77	441	All Dalits
6.		Bihunkot	Sahasra- dhara	Hill / Gravity- flow, New	11 0	748	Majority Brahmin / Chhetri
7.	Syangja	Kyakmi	Dagdi Bazar	Hill Gravity-flow New	62	410	Majority Ja- najati / Dalits
8.		Kewarebhan- jyang	Bankatta	Hill / Electric Lifting; New Single stage pumping	13 5	722	Majority Ja- najati
9.	Ru- pandehi	Parroha	Hariyali	Terai / Electric Lifting; New Single stage	10 2	510	Majority Brahmin / Chhetri
10.		Devadaha	Tallo Saran- tadi	Terai / Gravity- flow Rehabilita- tion	22	197	Majority Ja- najati

<sup>1</sup> sample number

## 1.5 Organization of the thesis

Chapter 1 gives background information for the topic of the thesis and presents the objective and scope of the thesis as well as sample size and selection of schemes. Chapter 2 provides theoretical background of the thesis. It basically explains the environmental sustainability, environmental policy, and world water background, water policies in Nepal, water situation in Nepal, environmental assessment tools selection and best available technology. Chapter 3 deals with methodology, sample size and sampling with justifications, checklists, data analysis and limitation of the study. Chapter 4 presents field observation results and discusses the findings. Similarly, Chapter 5 explains the best available technology for water treatments, focusing on two low cost technologies to inactivate *E.Coli* and lime from water. Chapter 5 explains the best available technology for water treatments, focusing on two low cost technologies to remove *E.Coli* and lime from water. And finally, chapter 6 presents the conclusion of study and recommendations for the RWSSP-WN project.

## 2 Theoretical background

The following sections will present the theoretical background for the thesis project. First, the concept of environmental sustainability is defined. Then environmental policies and environmental assessment tool selection are addressed with respect to the major stakeholders of RWSSP-WN. Similarly world water background and current water situation in Nepal explained briefly. Again several water policies of Nepal illustrated and the concept of best available technology has given.

### 2.1 Environmental sustainability

The United Nations (2005) has defined the concept of environmental sustainability as

meeting the needs of the present without compromising the ability of future generations to meet their needs. Encompasses, e.g. keeping population densities below the carrying capacity of a region, facilitating the renewal of renewable resources, conserving and establishing priorities for the use of non-renewable re-

sources, and keeping environmental impact below the level required to allow affected systems to recover and continue to evolve.




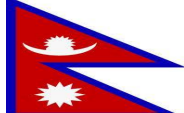
It also further explains that environmental sustainability can be expressed as a balance among the three pillars of economic, social and environmental protection.

Gbadegesin (2007) has explained several factors for the low-level sustainability of smallscale water supply systems, such as Unsuitable policy or legislation, insufficient institutional support, weak management system and regular technical support. Similarly, Gebrehiwot (2006) analyzed two major factors in order to determine the sustainability of rural water supply systems two major factors, Pre-Implementation and Post-Implementation. Pre-Implementation includes sub factors Community Involvement, Selection of Best Available Technology, Site Selection, Procurement Training and Construction Quality, while Post-Implementation consists of sub factors such as; Technical Support, Community Satisfaction, Financial Management, Post Construction Training, and Operation and Maintenance Training.

## **2.2 Environmental policies**

Many foreign projects are being conducted in Nepal, and they have their own environmental strategy and policies. Table 3 shows the environmental policies of two major stakeholders and two governmental acts and policies relevant to RWSSP-WN

Table 3. Environmental policies and acts of four stakeholders relevant to RWSSP-WN.

<b>World Bank (WB)</b> <b>Environmental Policy</b>	<b>Asian Development bank(ADB)</b> <b>Environmental policy</b>	<b>Government of Finland Envi-ronmental Acts</b>	<b>Government of Nepal En-vironmental Acts</b>
<p>OP4.01 Environmental Assessment</p> <p>OP4.04 Natural Habitats</p> <p>OP4.36 Forests</p> <p>OP4.09 Pest Management</p> <p>OP4.11 Physical Cultural Resources</p> <p>OP4.37 Safety of Dams</p>	<p>Safe Guard Policy Statement (SPS) (4Mar2001)</p> <p>Policy on forestry(1995)</p> <p>Project performance system policy (28 Oct 2011)</p> <p>Anticorruption policy (4 Oct 2010)</p>	<p>ENVIRONMENTAL PROTECTION ACT (86/2000; amendments up to 647/2011 included)</p> <p>Environmental Damage Insurance Act (January 30, 1998)</p> <p>Nature conservation act Finland(506/2005)</p>	<p>Water Resource Act 1992 (2049 BS)</p> <p>Environment Protection Act 1996 (2053 BS)</p> <p>Drinking Water Regulation 1998 (2055 BS)</p> <p>Environment Protection Regulation 1997(2054 BS)</p>
			

## 2.2 Environmental assessment tool selection

Big stakeholders, such as World Bank (WB) and Asian Development Bank (ADB), use the same environmental assessment (EA) tool selection process. In a case of a project, they first divide the project in four categories, which are described in Table 4.

**Table 4. Classification of project by ADB and WB for EA selection**

	<b>Category A</b>	<b>Category B</b>	<b>Category C</b>	<b>Category FI (financial intermediary)</b>
Environmental sustainability	<p>Very high environmental impacts</p> <p>Impacts may affect an area larger than that subject to physical works</p> <p>EA compares project feasible alternatives and their related impacts (including "No action")</p> <p>EIA (Environmental Impact Assessment) including EMP (Environmental Management Plan) is required</p>	<p>Potentially fewer adverse environmental impacts, mostly site-specific</p> <p>EA scope is narrower than the one for Category "A"</p> <p>EA examines the project negative and positive impacts</p> <p>Initial Environmental Examination (IEE) including EMP is required.</p>	<p>Minimal or no adverse impact</p> <p>Technical assistance projects on institutional development, computerization, and training</p> <p>IEE or EIA is not required, even though environmental implication need to be reviewed</p>	<p>Involve a financial intermediary; investments are done through sub-projects with different environmental impacts</p> <p>The FI screens each subproject proposed for financing, and classifies it into any one of three categories: A, B or C</p>

	Category A	Category B	Category C	Category FI
Examples	Large scale hydro-power projects, City landfill construction,  Gas pipe line construction,	Micro-hydro power plants, small sanitary landfills,  Rehabilitating an existing infrastructure (e.g., roads, power, transmission and irrigation networks)	Education and Health projects not involving construction;  Rehabilitation of a limited number of small buildings	Projects using community development driven approach and social funds;

### 2.3 World water background

Approximately, 1.4billion km<sup>3</sup> or 97.5 percentage water is contained in earth, among them 2.5 percentage is freshwater resources However, 70% of the freshwater is in the form of ice and snow and 30 % is stored in the ground in the form of groundwater. In addition, UN points out that by 2025, 1800 million people live in high water scarcity region, and about two-thirds of the world population could be in water stress condition. (UN water statistics).

Every year, about 1.9 million deaths, primarily of children under five years of age, are caused by unsafe drinking-water, inadequate sanitation and hygiene (WHO, 2008a). The World Health Organization (WHO) estimates that improving water, sanitation and hygiene (WASH) could prevent approximately 9.1% of the global burden of disease and 6.3% of all deaths (Prüss-Üstün, Bonjour and Corvalán, 2008). About 780 million people drink water from unsafe sources, and millions of others drink contaminated water from safe sources (UNICEF/WHO, 2012). Supplying potable, reliable pipeline water to each household is the ultimate purpose of WHO and the United Nations Children's Fund (UNICEF) ; it would yield the greatest health gains and promote/support the Millennium Development Goal(MDG) , which focuses on poverty reduction, nutrition,

childhood survival, school attendance, gender equity and environmental Sustainability. While pursuing that long-term goal, WHO and UNICEF are also committed to incremental improvements in drinking-water supplies. One such approach is household water treatment and safe storage (HWTS). A growing body of evidence demonstrates that the use of HWTS methods improve the microbial quality of drinking water and reduces the burden of diarrheal disease in users (Fewtrell et al., 2005; Clasen et al., 2007; Waddington et al., 2009). On the basis of this evidence, HWTS has been recommended in the WHO Guidelines for Drinking-water Quality (GDWq).

United Nation's *World Water Development Report* (2005) informs that by 2050, at least one in four people is likely to live in a country affected by chronic or recurring shortages of freshwater. It clearly seems that there are lots of reasons to consider water and sanitation as the first priority of the world's agenda.

## 2.4 Water situation in Nepal

According to WHO (2008), 89 % of the total population of Nepal has access improved drinking water source. Among them 94% live in urban region and 88 % in rural region. Similarly, 27% of the whole populations have been provided improved sanitation; 45 % of this population lives in urban region and 24 % in rural area. (WHO, 2008)

According to WHO, one person needs 2.5 to 3 lpd (liter per day) to survive; this includes drinking and food. Similarly 2 to 6 lpd is required for basic hygiene practice and 3 to 6 lpd is essential for the basic cooking purpose. In overall, 7.5 to 15 lpd is needed.

In order to provide drinking water for the poorest and excluded people, Government of Nepal has a five-year and a three-year plan. The most recent plan called Three-Year Interim Plan (TYIP 2010-2013) analyzes that approximately 80% of all the inhabitants have got access to a drinking water facility and 43% have got sanitation service.

Its main strategies include providing reliable drinking water and sanitation services to all by 2017 by gradually increasing the quality and service standard of the drinking water. It promotes and extends sanitation facilities through public awareness in rural and urban areas with the participation and contribution of the local government and



users' communities and introduces the necessary policy, institutional and legal reforms for adopting Sector Wise Approach (SWAp). It also aims to construct environment friendly (including adaptation to climate change) infrastructures of drinking water and sanitation that would utilize and improve the quality of drinking water to meet standards set by the National Drinking Water Guidelines.

The TYIP is expected to result in the following outcomes:

- 85 % of the total population should have access to a drinking water facility.
- 60% of the people should have access to a sanitation service
- 15% of the people should have access to a drinking water service with medium high standards.

## **2.5 International water rights**

Water right is the right which defines the ownership and use of water resources. It allocates water to different users and can be applied where water supply is not sufficient for the demand. Where the people are deprived of access to water. Water right is considered to be a basic human right, which has to be reconciled with legal water rights already in existence. It is a matter of fact that privatization and co-modification of water often undermine this right by not supplying of water to those people who could not pay for this.

## **2.6 Water Acts in Nepal**

This section deals with water policies in Nepal. First, the Water Resources Act, 1992 is described, then Land Acquisition Act 1977.

### **2.6.1 Water Resources Act, 1992 (2049/9/2)**

The legislation on water resources is explained in Water Resource Act, 1992. This act is basically about the utilization, development and conservation of the water resources in the country. It states that the State is the owner of the water resources of the country. This Act grants the right to use water to individuals, organizations and the private

sector. In order to use the water resources everybody should have a license under this Act. The license has to be renewed every year by paying a prescribed charge.

There are some cases where a license is not required to use the water resources:

- Use for private purposes, e.g. as drinking water or for other domestic activities,
- Irrigation of personal land,
- Use of the running water-mill or water-grinder as cottage industry, and
- Boating on personal basis for local transportation.

Section 16 of the Act deals with the utilization and acquisition of land and house. This Section allows the licensee to submit an application to the Government to explain the water quality standards, water pollution and adverse effect on the environment. Sections 18 and 19 allow the Government to prescribe pollution tolerance limits and water quality standards for various uses. Similarly, Sub-section 2 of Section 19 prohibits any person from polluting water resources to the effect that the prescribed tolerance limits are exceeded.

## **2.6.2 Land Acquisition Act, 1977**

The Land Acquisition Act, 1977 empowers the Government to acquire land for development purposes, by paying compensation to the landowner. The Land Acquisition Guidelines, 1993 have been issued to facilitate the acquisition process under the Act. The Act clearly empowers the Government to acquire necessary land and fixed property of any owner for development use and welfare, diplomatic mission, international organizations after issuing public notice and completing required procedures. Under this Act, the Government can also acquire land for public and private corporations, organizations, private firms for public use and welfare. However, the Government shall not acquire land for corporations, organizations and private firms for agriculture purpose except for research purpose under this Act. The Government shall provide compensation to the concerned person and organization as decided by the Compensation Fixation Committee. The compensation rate to be determined may differ for person whose land was wholly acquired or for those whose land was partially acquired. There are different provisions regarding the compensation rate:

- Compensation rate to landowner whose land has been acquired for government-owned institutions, organizations and local bodies;
- Compensation rate to landowner whose land has been acquired for other institutions and organizations; and
- Compensation rate to land owner whose land exceeds land ceiling according to Land Reform Act, 1964 (2021 B.S.) acquired for government-owned institutions, organizations and local bodies.

Land acquisition through negotiation is an important aspect included in Section 27 of this Act which has a provision that the Government can acquire land through direct negotiation with the owner. This will minimize dissatisfaction of landowners regarding compensation and loss. Section 34 of the Act has a provision that the acquired land should be returned to the owner if it is not required. Similarly, the Government may also cancel its decision regarding land acquisition.

## **2.7 Best available technology**

Firstly, the concept of Best Available Techniques (BAT) was introduced as key principles in the integrated pollution prevention and control (IPPC) Directive 96/61/EC, and it has been incorporated into the Irish law as the Environment Act 2003. In order to achieve the requirement of the IPP directive in the Irish law, relevant sections of the Environmental Protection Agency Act 1992 and the Waste Management Act 1996 have been amended to replace BATNEEC (Best Available Technology not entailing Excessive Costs) with BAT. Hence, this technology must be applied for those activities, which fall under the area of the Directive and the above-mentioned Acts in the Irish law.

The term BAT, B refers to 'best' which means the most capable technique in getting a high level of protection of environment as a whole. Likewise 'A' refers to 'available technology' which means technology that could be suitable in any situation and any condition. It should be mostly economically feasible, environment friendly, easy to operate. Similarly, 'T' refers to 'techniques' which can be applied in an appropriate situation.

According to Finish environmental act (section 3, p 2), the term BAT(Best Available Technology) “refers to methods of production and treatment that are as efficient and advanced as possible and technologically and economically feasible, and to methods of designing, constructing, maintenance and operation with which the pollution caused by activities can be prevented or most efficiently reduced”.

Under the U.S. Environmental Protection Agency Acts, 1992 and 2003 and Section 5(2) of the Waste Management Acts 1996 to 2005, Bat is defined as

*most effective and advance stage in the development of an activity and its methods of operation, which indicate the practical suitability of particular techniques for providing, in principle, the basis for emission limit values designed to prevent or eliminate or, where that is not practicable, generally to reduce an emission and its impact on the environment as a whole.*

The best available technology in rural water supply systems should be targeting cheaper investment and O&M cost, easy to use and the material used in technology should available in local area. There are array of technologies which differ with respect to contaminant removal from drinking water. For example, *E-coli* is the one of the common contaminants in drinking water; in order to get rid of this contaminant most of the researcher have proposed a large variety of filtration technologies for rural communities. The technology for the RWSSP project should be the cheapest and could be made from easily available materials. Lime (calcium Carbonate) is another common contaminant in drinking water. There are lots of technologies used to get rid of lime, for example, Zeolite technology, which has just been taken into use in the Kanchanpur district in Nepal.

### **3 Study Approach and Methodology**

The following sections present the major steps/methods followed to carry out this thesis project.

### 3.1 Desk Study / Review of Relevant Documents

The main part of the information required in the thesis project was collected by reviewing some of the relevant documents of RWSSP-WN, which also helped to understand the working approach and modality of the project. The following were the some of the major documents that were reviewed:

- Revised Project document (PD) of RWSSP-WN
- District WASH implementation guideline (DWIG) with its Annexes
- Annual and Trimester progress reports
- Training Norms
- Journals(see in references)

Apart from the above documents of RWSSP-WN some other documents relevant to the topic of the thesis were also reviewed. Some published journals, books, communication with experts, web materials and some lectures notes were used to find out the best available technology to remove *E-coli* and lime.

### 3.2 Field Tools / Questionnaire Preparation

After reviewing the documents, a questionnaire was prepared. Refer to Appendix 5 in order to study Environmental sustainability, questions on post construction schemes were prepared to cover the following aspects:

(1) **Institutional Capacity/Status of WUSC** (e.g. capacity building training imparted to WUSC, WUSC formation, formal registration, future O&M plan, regular operation of the system, day-to-day scheme management, and WUSC meeting),

(2) **Technical Aspect** (e.g. number of structures designed and actually built, construction quality and workmanship of intake and other structures, arrangement of collection chamber ,and distribution chamber and pipe line alignment),

(3) **O&M Management / Financial Aspect** (e.g. Payment status to WUSC; contribution pattern from DDC, VDC and community; initial and current O&M status; water tariff

collection practice; provision of Maintenance Worker and its payment, and public hearing and public audit carried out by WUSc for transparency), and

(4) **Environmental Aspect** (e.g. existing or possible environmental threats such as landslide, lightning, flooding, water contamination; existing protection work/mitigation measures carried out; and adequacy of measures taken)

### 3.3 Methodology of the field survey

Apart from collecting some information from secondary sources (literature review and use of MIS data available at RWSSP-WN), field level observations and discussions were performed to obtain primary information about the selected schemes. In order to obtain reliable information, Participatory Rural Appraisal (PRA) tool has been applied i.e. Focus Group Discussion (FGD), key informant interview (e.g. interview with Maintenance Worker/Pump Operator, WUSC Chairperson, Treasurer, and Secretary), and interactions with users' community/beneficiaries. The detailed physical observation of the scheme or system from source/catchment to taps is one of the vital tools that was used to collect information, and on the basis of that observation, interaction with the WUSC members/users was started to obtain their feedback.

During such interaction with WUSC, an attempt was made to assess their organizational/institutional capacity in managing the scheme, level of knowledge/awareness on water quality/water safety plan (WSP) and sustainability of the scheme including environmental aspects as already mentioned in detail when defining the scope of the thesis in section 1.3.

### 3.4 Data analysis and presentation

As mentioned above, secondary data were collected from relevant source materials and MIS software and primary data were collected from the observations of the field visit, discussions with community and district people (WASH Unit staff/Service providers). After that, the data was analyzed as well as presented using simple statistical methods e.g. average, percentage, and mean found in mathematical software (Excel). Wherever appropriate, an attempt was made to present the data in pictorial form, e.g.

tables, bar and pie charts and also by case boxes. The field visit reports including photographs taken and results from the questionnaire are attached in appendices.

## **4 Field observation results and discussion**

### **4.1 Status of the schemes**

The data that were collected during the field visits are summarized under various topics which represent the status of the scheme. On the basis of the observations, the structure and quality of the material used in the schemes were evaluated in the form of charts and tables.

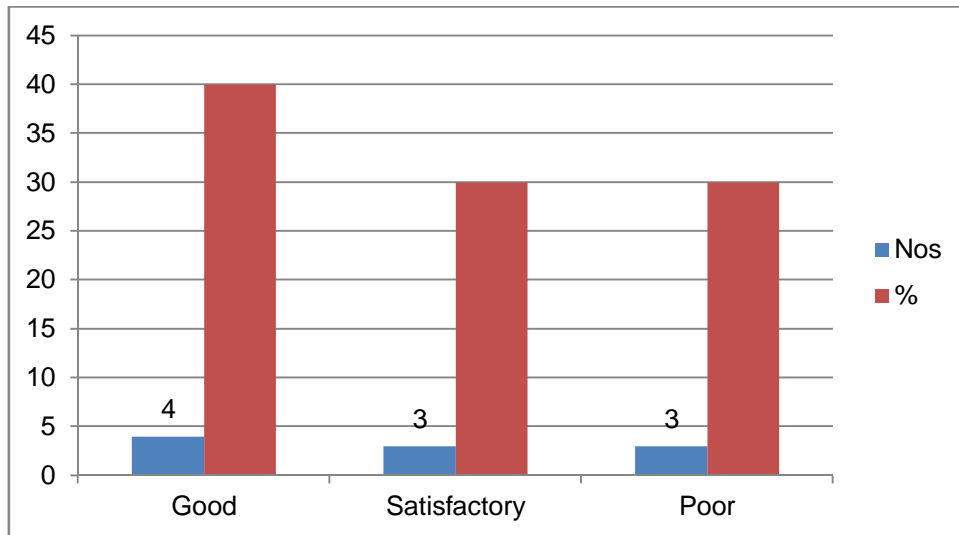
#### **4.1.1 Water supply system and sanitation condition prior to the scheme delivery**

Most of the communities were using unprotected natural sources such as springs, well rivers and streams. Some people were using the tap of their private water supply system in the scheme area. The water from wells, stream and river were more turbid during the rainy season. These sources also used to get polluted due to multiple usages. The people faced acute shortage of water in dry season when sources were completely dried. Therefore, people were completely bound to use more than one source. Similarly, people were compelled to spend lot of time on getting water.

Most of the communities were using water sources which are very far from home, for example some of the sources were so far, about 4-5 hour's distance by foot and thereafter they have to waiting in a long Que. Again they have to be in a big queue. During the field visit at Tanahun, one local man explained that after the scheme construction, 30 % of people's times have been saved. Especially, the women in the community are getting more and more relief after the completing the scheme.

The sanitary conditions surrounding the water source of 10 selected scheme was evaluated and it was found that four schemes had good sanitary conditions,3 schemes had

satisfactory sanitary conditions and 3 schemes had poor sanitary conditions surrounding the source(Figure 3).



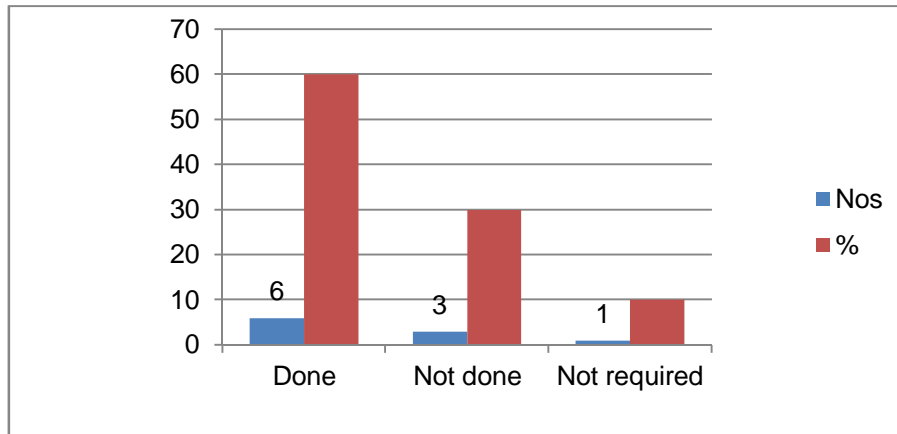
**Figure 3. Sanitary conditions of the selected schemes**

#### 4.1.2 Source Protection Works

It is necessary to provide protection work to the source; otherwise, if the source got damaged by any factors, it would affect the whole system and obstruct the smooth operation of the system. Hence, source protection work, such as barbed wire fencing surrounding the intake against human vandalism, floods and landslides, gabion wall construction, vegetation/greenery at upstream the source, and upstream drain to avoid the entry of unwanted debris entering in to the intake are to be carried out in the scheme.

During the thesis project, it was found that source protection had been done properly in six schemes and that source protection had not been properly carried out in three schemes. It was also reported that such protection work was not required in one of the scheme. This means there was no possibility of environmental threats in that scheme. Figure 4 shows the source protection measure taken around the source.

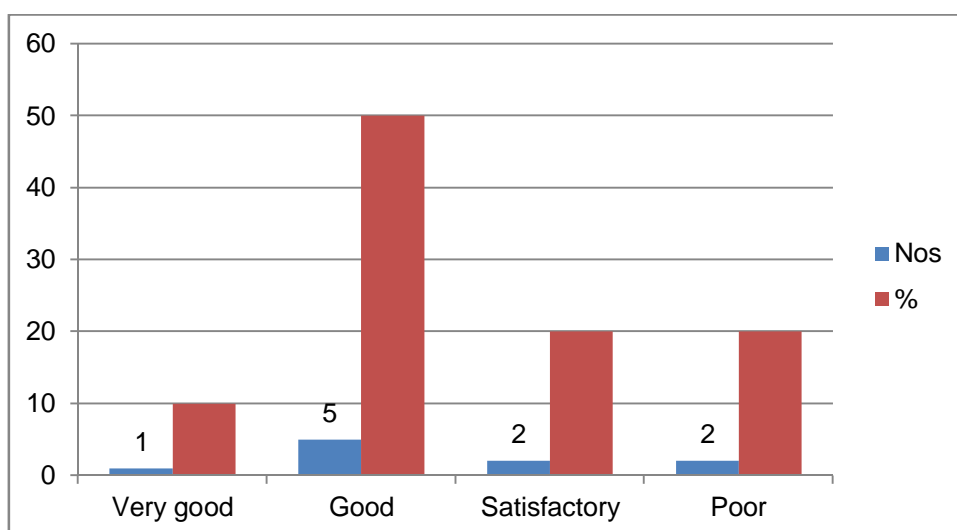




**Figure 4. Source protection measure taken of the selected scheme**

#### 4.1.3 Appropriateness of technology and quality of construction

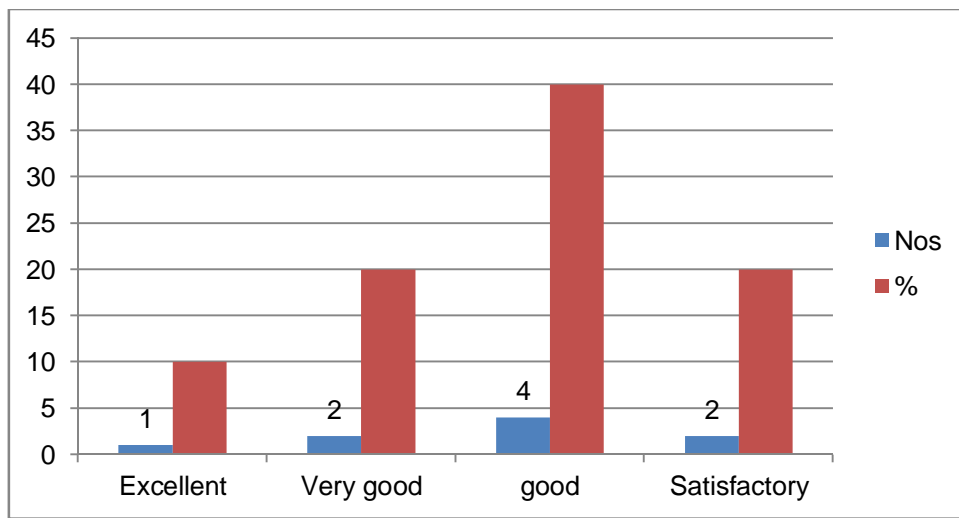
The technology used in most of the scheme was appropriate for the scheme area. However, there were some complaints from people of scheme area with respect to selection of technology. For example, Intake design for those schemes which were affected by lime should have been done in a different way, which could increase the sustainability of the schemes. It was also found that, after the construction of the schemes, many people in the community had become more knowledgeable about the technical options and the operation of the scheme. Figure 5 explains the quality of construction of selected schemes.



**Figure 5. Quality of the constructions of selected schemes**

#### 4.1.4 Operational status of water supply system

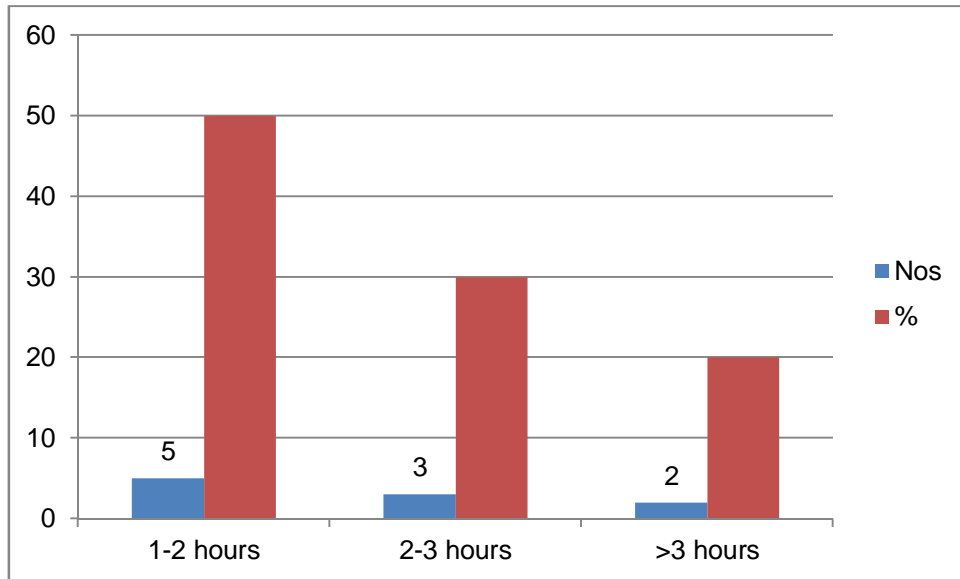
During the study, it was found that in two schemes, there was excellent operational status, two schemes had very good operational status and four schemes had good operational status. And it was also noted that two schemes had satisfactory operational status. See further information on appendices. Figure 6 shows the operational status of the water systems.



**Figure 6. Operational status of the water supply system**

#### 4.1.5 Water fetching time utilization after scheme implementation

After the scheme delivery, the communities had benefitted from the scheme to a greater extent. Before the scheme implementation, people and especially women from the community had to spend a lot time on fetching the water. After the implementation, people did not need to travel a long distance to fetch water since a large number of taps had been constructed in several communities. Because of this, people are able to save time daily such that they can utilize the saved time on various activities, such as reading, writing, agricultural work, business activities, income generation activities and taking care of children. Figure 7 illustrates the number of schemes for water time fetching after the scheme implementation.



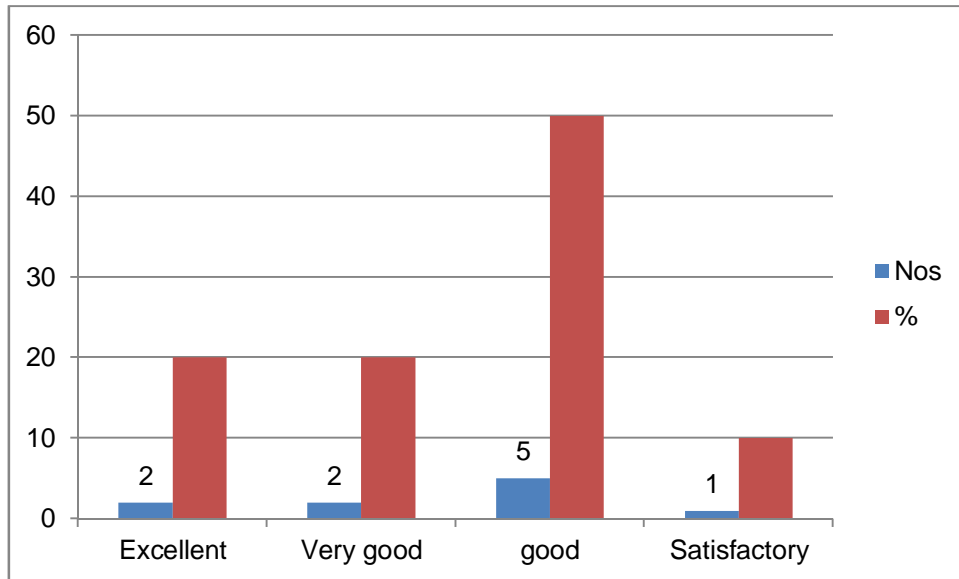
**Figure 7. Water fetching time utilization after scheme implementation**

#### 4.1.6 Technical capability of WUSC for Operation and Maintenance (O&M)

The proper technical capability of rural water supply systems is a crucial factor for the sustainability of the water project. The community management of rural water supply systems' operation and maintenance (O & M) will not be successful, if the users committee is not aware about the maintenance. Then, the scheme will not be sustainable.

Overall, the performance of the community was found good in all schemes. They have mobilized the resource from various sources for upfront cash contribution and O&M fund, collected local materials by mobilizing human, construction material and financial resources, contributed land and participated in all phases of the scheme.

As shown in Figure 8 below, two schemes had excellent technical capability for O & M. Similarly, two schemes had very good technical capability, and five schemes had good technical capability. And also it was found that one scheme had satisfactory capability for O & M.



**Figure 8. Technical capability of O & M of selected schemes**

## 4.2 Environmental activities around the schemes

It was noted that in some of the schemes have very high possibility of degradation of environment around the scheme area due to the scheme construction and other development activities. During the field visit following environmental threats were observed: Landslide and erosion, fire, pesticides, lightning, lime and flooding and run off are describe in more detail in the following subsections.

### 4.2.1 Landslide and Erosion

It was found that four out of ten schemes had a landslide and erosion problem. Table shows the schemes having the possible landslide and erosion.

Table 5. Landslide and erosion in schemes

Name of scheme	Impact zone	Existing/possible Impacts on the scheme area	Mitigation Measures Adopted in the period of implementation	Suggested Mitigation measures to be adopted
Nabarjung	Intake, First pumping station and transformer area	Debris were collected inside intake, landslide above the first pumping station	"Earthing has been done but none of the other measure have been done."	Lightening arrester needs to be connected to the transformer, Plantation needs to be started and debris should be removed.
Handebhir Krosebar	Intake/tapping point, distribution Pipelines	Landslide may occur at Intake and tapping point , Erosion could occur in distribution pipelines	Stone has been used in order to protect from the erosion.	Intake should be placed in safe location under rocky part. Pipeline needed to be buried in adequate depth. Boulder packing needs to be done properly in intake with a system of diversion of run-off water.
– Saharsadhara	Intake	Heavy flooding in river may cause the landslide at intake.	Supporting wall has been provided around the source tank.	WUSC has to construct drainage to divert the runoff water from the hill near RVT.

<b>Name of scheme</b>	<b>Impact zone</b>	<b>Existing/possible Impacts on the scheme area</b>	<b>Mitigation Measures Adopted in the period of implementation</b>	<b>Suggested Mitigation measures to be adopted</b>
Hariyali	RVT and transformer	Sliding at north part of RVT.	No proper protection measure adopted during and operational phases.	Plantation above the RVT need is to be done.

#### 4.2.2 Fire

Possible fire was also observed in two schemes. In this case, the fire could damage the pipelines and drying the water source out. Table 6 shows the possible fire problems in the selected schemes. Table 6 Fire problems in selected schemes.

**Table 6. Fire problems in the schemes**

<b>Name of scheme</b>	<b>Impact zone</b>	<b>Existing/possible Impacts on the scheme area</b>	<b>Mitigation Measures Adopted in the period of implementation</b>	<b>Suggested Mitigation measures to be adopted</b>
Chhatimane	Pipelines nearby intake.	In dry season, Possibility of fire is quite high; therefore, the open pipelines within these areas could burn.	No proper protection measures adopted during implementation and operation phases.	Pipe should be buried in adequate depth in a proper way.
Tallo sarantandi	Pipelines from intake till collection chamber			

### 4.2.3 Pesticides

It was noted that in one scheme pesticides used by farmer were easily mixed with the water source (Table 7).

**Table 7. Pesticides problems in selected schemes**

Name of scheme	Impact zone	Existing/possible Impacts on the scheme area	Mitigation Measures Adopted in the period of implementation	Suggested Mitigation measures to be adopted
Dagdibazzar	Intake	Pesticides used in farmland could contaminate the source of the scheme.	No proper protection measures adopted during implementation and operation phases.	Appropriate solution needed to be used in discussions with with the WUSC and land owner.

### 4.2.4 Lightning

Table 8 shows that two of the schemes could be affected by lightning

**Table 8. Lightening problems in the selected schemes**

Name of scheme	Impact zone	Existing/possible Impacts on the scheme area	Mitigation Measures Adopted in the period of implementation	Suggested Mitigation measures to be adopted
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Nabarjung Water Scheme & Hariyali wa- ter scheme	Transformer	Lightning could damage the transformer which could lead to a failure of the scheme.	Earthing has been done in all possible threat schemes.	Strong lightening arresters need to be connected.
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In sample schemes, most of them are gravity technology type, which don't need any electrical appliances so they don't need of lightening arrester.

#### 4.2.5 Lime

Table 9 shows the schemes where a lime problem was observed. It was also noted that because of lime, the pipelined blocked and schemes almost failed. So it is strongly recommended to use proper technology to get rid of this of problem

**Table 9. Lime problems in selected schemes**

<b>Name of scheme</b>	<b>Impact zone</b>	<b>Existing/possible Impacts on the schema area</b>	<b>Mitigation Measures Adopted in the period of implementation</b>	<b>Suggested Mitigation measures to be adopted</b>
Tallo sarantandi water scheme & Hariyali water scheme	Water quality and pipelines	Pipelines will be totally blocked within 2-3 years. This decreases durability of the scheme.	No proper protection measures adopted during implementation and operation phases	Lime treatment method should be applied at source. (For the recommended technology see 5.2)



#### 4.2.6 Seasonal impact of rainwater

During the field visit it was observed that three schemes have possible impact seasonal water in its components. Table 10 shows the seasonal impacts of rainwater observed during field work including suggestions of mitigation measure to be adopted.

**Table 10. Seasonal impact of rainwater**

Name of scheme	Impact zone	Existing/possible Impacts on the schema area	Mitigation Measures Adopted in the period of implementation	Suggested Mitigation measures to be adopted
Handevir krosebar	Source tapping point and intake	Contamination of water and sedimentation with the possible landslide and erosion	No proper protection measures adopted during implementation and operation phases	Protection of Source/Intake through boundary and spillway of rainwater
Saharsadhara	Intake			
Dagdibazzar Tallo saran-tandi				

#### 4.2.7 Flooding and run off

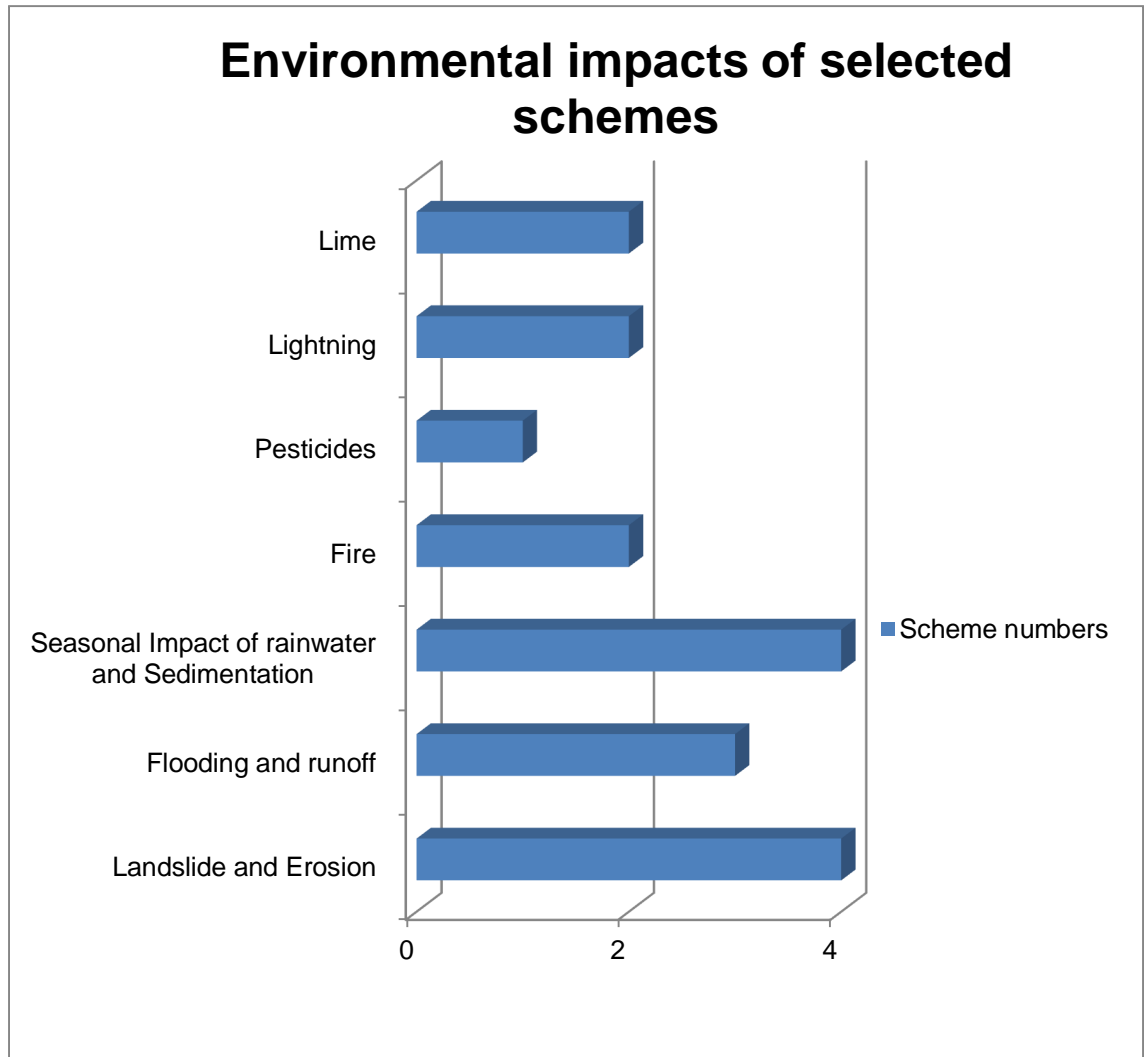
Flooding and run off problems observed during the field work is explained in Table 11.

Table 11. Flooding and run-off problems in the schemes

Name of scheme	Impact zone	Existing/possible Impacts on the schema area	Mitigation Measures Adopted in the period of implementation	Suggested Mitigation measures to be adopted
Odare Jukepani	Intake	Possibilities to enter run-of water inside intake and intake cover (GI) sheet are damaged.	In order to protect intake, they have used GI sheet but this time that has been damaged.	GI sheet is needed to be replacing by concrete slab at intake. Boulder packing need to be provide above intake to protect water quality
Jukepani	2nd intake	Possibilities to enter run-off water in 2nd intake.	Poorly done boulder packing, which cant diverse the runoff water.	Boulder packing need to be done in 2nd intake with the system of diversion of runoff water.

#### 4.2.8 Environmental impacts on selected scheme (by number)

As it is explained in earlier chapter 4.2, Figure 9 illustrates the environmental impacts in sample scheme. During the field visit, it is noted that in two schemes have possible lime, fire and lightening problems. Similarly one scheme had pesticides problems. And four schemes have possible landslide and erosion and seasonal impacts of rainwater and sedimentation.



**Figure 9. Chart showing the environmental impacts of selected schemes**

#### 4.2.9 Environmental assessment

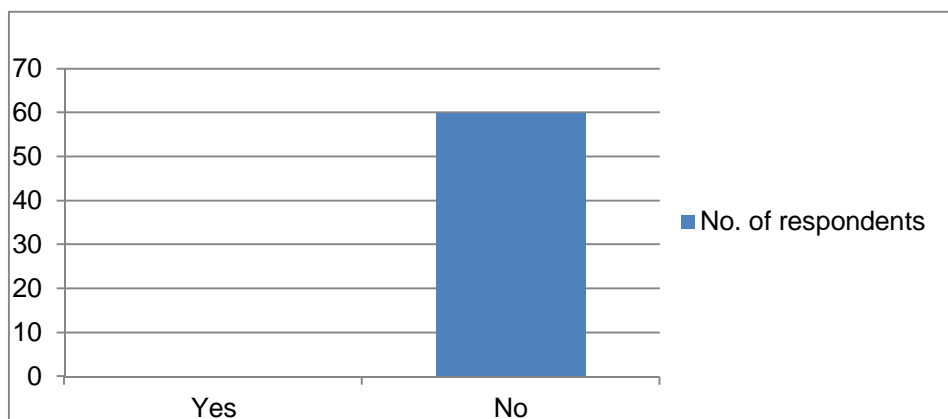
All the projects in Nepal have to follow the national policy which is explained under Environment Protection Act 1996 (2053 BS).

The act explains the conditions of certain project to conduct an EIA (Environmental Impact Assessment) or IEE (Initial Environmental Examination). In order to be forced to conduct IEE or EIA, the project need to fulfill one of the criteria explained in Table 10.

Table 12. Condition to conduct IEE or EIA in Nepal

Variables	IEE	EIA
Collection of rain water area	<200 Hector	>200 Hector
Discharge	(10-25)L /Sec	25 L/s
Construction Tunnel	<1km	>1 km
Population	2000–20,000	>20,000
Length	<20km	-
River diversion	<1 km	>1km
Cutting national forest	Up to 5 hector	5 hector

According to Figure 10, none of the studied sample schemes needs to conduct IEE or EIA, but as the MIS data showed, some schemes should conduct IEE.



**Figure 10. Environmental requirements of selected schemes**

### 4.3 Sustainability of the schemes

#### 4.3.1 Sense of ownership

Community ownership and management is the key issue of sustainability in rural water supply projects. The people living in the community are the actual owners and users of end result of the project. This means the community makes the final decision on major aspects of planning and management. Nowadays participation of the community in the different phases of the project is handled by many NGOs, governments and other stakeholders.

A community taking all the responsibility for managing the water supply system is one indicator of the sustainable community management in rural water supply system, and positive thinking towards the project makes the scheme sustainable and long lasting.

In all the sample schemes, it was found that all the people feel positive about the ownership of the scheme.

#### 4.3.2 O&M Tools, Equipment status and practice

Most of the schemes were found to have good knowledge about operation, maintenance tools and equipment. They had been utilizing the appropriate tools for the

maintenance of the scheme. In some cases, the tools had been used for some other community development work purposes. The tools are purchased by WUSC members, especially the secretary and the chairperson, along with other non-local material procurements.

#### **4.3.3 Collection of future O & M Fund**

In the sample schemes WUSC has collected O & M fund for the future. Most of the schemes had collected per house hold even though some had collected according the amount of water usage. For example, Dagdibazzar water scheme had collected Rs.50 for per 15 unit's use of water and Rs.5 for each additional unit.

It was noted that users committees had saved some amount in their O &M bank account for the future O & M purposes.

#### **4.4 Overall sustainability of the selected schemes**

As already explained in section 3.2, the sustainability of the sample schemes was studied under four categories. The schemes were evaluated on the basis of the field visit observation report, pictures taken during the visit and questionnaires, which can all be found in the appendices. Table 11 shows the overall sustainability of the schemes.

In overall 17.5 % of the total number of sample schemes was working excellently from all aspects, which could be the more sustainable than expected. Similarly, 22.5 % of the scheme was working well and 37.5 % of total number of schemes was in good condition. In the same way, 20 % of total sample scheme have to improve all parts, most of them have to improve on institution and environmental part. Again 2.5 % of the schemes were found to be in poor condition. So these schemes have to be improved in many aspects. Improvement suggestions for all schemes are given in appendices.

Table 13. Overall sustainability of the selected schemes

S. N.	Aspects of Evaluation	Excellent		Very good		Good		Satisfactory		Poor	
		No of Scheme	%	No of Scheme	%	No of Scheme	%	No of Scheme	%	No of Scheme	%
1	Environmental	0	0	2	20	4	40	3	30	1	10
2	Institutional	5	50	4	40	1	10	0	0	0	0
3	Financial	1	10	2	20	5	50	2	20	0	0
4	Technical Aspect	1	10	1	10	5	50	3	30	0	0
Average			17.5	2.25	22.5	3.75	37.5	2	20	0.25	2.5

## 5 Best available technology in water treatments

### 5.1 Methodology for selecting technology

For the selection of best available technology the primary use, affordability and appropriateness of each possible technology have been studied as a basis of selection. Criteria established for the selected technology are (1) low cost (2) Easy to operate (3) Primarily applied to domestic use and (4) Sustainable method.

### 5.2 *E.coli* inactivation technology

During the interaction with the community it was found that and also progress report of RWSSP-WN stated that several schemes are affected by *E.coli* problem. Furthermore, it was also noted that users were not even aware of low cost technology. In some districts like *Rupandehi*, *Tanahun* and *Syangja*, the presence of coliform and *E.coli* has become serious matters. *E.coli* and the best available technology in order to remove this pathogen are described in the following subsections.

#### 5.2.1 Introduction to *E.coli*

Fecal coliform are those bacteria which are associated with human or animal waste. The presence of fecal coliforms in water may not be directly harmful and does not necessarily indicate the presence of feces in water; however it indicates the high possibility of harmful pathogens in water. The presence of *E.coli* in water is an indication of sewage or animal waste in water. Sewage or animal waste might contain many types of disease-causing organisms.

*Escherichia coli* belong to the coliform group of bacteria, and are to Proteobacteria phylum. Members of this group are rod-shaped facultative anaerobic G-bacteria so *E.coli* fits in the Gamma protobacteria class. Commonly this bacterium found in the intestine of warm-blooded organisms. Normally it doesn't occur in natural source, such as soil, water, plants. But there was some proof that E-coli can also grow in soil (Winfield and Groisman, 2003; Byappanahalli et al., 2006; Ishii et al., 2006). The *E.coli* concentration inside human and animal feces is about  $10^9$  cells per gram (Edberg et al., 2000). This



bacterium may bring serious health problems, such as gastrointestinal illness, common illness, high blood pressure, kidney damage, and in severe cases peoples may even die.

*E-coli* contaminated water means that the water is mixed with waste from warm blooded animal waste. Some of the communities were using open defecation sources, as rivers, lakes, and when those sources are used as drinking water sources and if the water is not treated properly, and then *E.coli* easily appears in drinking water.

Survival time of this bacterium depends on many conditions: temperature, pH, sunlight, and quality of water. Normally, *E. coli* can live approximately 4-12 weeks in water containing a moderate microflora at a temperature of 15-18°C. *E. coli* has been detected in the biofilm; it generally makes up a small portion of the total coliforms isolated.

Treatment technology is differs with respect to the contaminants. Table 12 shows technology available for removing *E.coli* from water.(Health Canada, 2011)

**Table 14. Commonly used technology to remove E-coli from water.(Odell, (2010))**

E-coli removal technology			
Filtration	Membrane process	Ion exchange	Chemical disinfection
Filtration coagulation	Reverse Os- mosis	Electodialysis reversal	Ozonization
	Nanofiltrraion		Chlorine
Biological filtration	Ultrafiltration		Chlorine dio- xide
	Microfiltration		Chlorimine
			Peroxide UV

### 5.2.2 Detection of *E-coli*

There are three techniques, commonly used to find out the *E-coli* organisms in water. Presence – Absence (P A) technique, which is a qualitative test. Similarly, two other quantitative tests are membrane filter (MF) and multiple tube fermentation (MTF). All of these techniques use cultivation to detect the presence of E-coli. For the drinking water supply systems P A test is more sensitive, more economic and efficient (Clark and Vlassoff, 1973). Nowadays, PA method is the most preferred method everywhere. In this method only one analysis bottle is used. By this techniques presence of *E- coli* can be found either in single step by using enzyme-based media (e.g. media based on defined substrate technology) or in second step by using presumptive coliform media (e.g.using lauryl tryptose broth). According to the data presented by Edberg and Edberg (1988), the media based on defined substrate technology can detect coliforms within 24 hours.

In addition, the membrane filter method is used to detect the *E-coli*. In this method, the water sample is passed through a filter which collects the bacteria, and *E- coli* will be confirmed by using cultivation either in single step or second step using different kinds of the media.(Health Canada, 2011)

### 5.2.3 Applicable technology for the selected schemes;

Most of the technology explained above, is not applicable in the selected scheme. Most of them are costly and require high technical capacity. Applicable technologies for the sample schemes are described as follows;

### 5.2.4 Disinfection by using chlorine

According to national water quality standard of Nepal for drinking water *E-coli* concentration limit should be zero. So, project should follow to maintain the national water quality standard in its all schemes.

Disinfection by using chlorine could be the best technology to use for RWSSP-WN schemes. In order to use it, contact time of chlorine with water and the amount of chlorine are needed taken in to account.

According WHO (2011) 2 mg/L of chlorine required to destroy all organisms. In order to use this Chlorination, WHO further explains that the turbidity level should be <5NTu. Similarly, pH level need to be between 7.2 and 6.8. The minimum time of chlorine needs to be in touch with water is 30 minutes.

In case of RWSSP-WN project's schemes a suitable amount of chlorine could be added to the intake or also in the distribution chamber on a regular basis. Then the chlorine level in water is also needs to be checked all the time to check that chlorine is working, properly.

Efficacy of chemical disinfectants can be determined by using **CT concept**, where, C refers to residual concentration of disinfectant (g/L) and T refers to time of disinfectant with water (minutes). With the help of this concept the amount of disinfectant required in the water can be calculated.

Table 13 below shows a comparison of Disinfectant performance at a 99 % CT value. (99 % of E-coli are disinfected by the disinfectant).

**Table 15. Comparison of disinfectant performance at 99 % CT value. (99 % of E-coli are disinfected by the disinfectant) (Health Canada, 2011).**

Disinfectant agent	pH	E.coli(a) (mg*min/L)
Free chlorine	6-7	0.034- 0.05
Performed chloramines	8-9	95-180
Chlorine dioxide	9-7	0.4-0.75
Ozone	6-7	0.02

From the table it can be conclude that inactivation of coliform bacteria is very easy by using even common chemicals. It can been seen in the table 13 that the Ct value of chloramines is higher than the CT values of others. In order to have similar perfor-

mance with chloramines, concentration(c) or contact time (t) need to be increased for other chemicals or it also can be done by increasing both C and T.

### 5.3 Filtration removal method

Filtration is also a possible household water treatment device to get rid of *E-coli*. Several types of filtration device, which could be applicable for the project are presented in the following subsections.

#### 5.3.1 Biosand Filters (BSF)

A Biosand filter is normally used at household level; it is made of local material, and it is also the best method to reduce of *E-coli* type of bacteria. Biosand filters are made of a concrete or plastic vessel fitted with filtration media. The typical structure of this kind of filter is illustrated below. Biosand filters have a production rate of 30-40 L/h if the height is 95 cm and the width 36 cm. Similarly, its life span is more than eight years. Likewise, its performance rate is 0.3–4 LRV (log reduction value) bacteria, 3.8–5 LRV protozoa, 0–1.3 LRV virus and 96% turbidity removal. (Loo, Fane, Krantz, Lim, 2012).

Figure 11 shows the typical structure of Biosand Filters. In Figure b, zeolite has been used, and in Figure a, fine sand has been used.

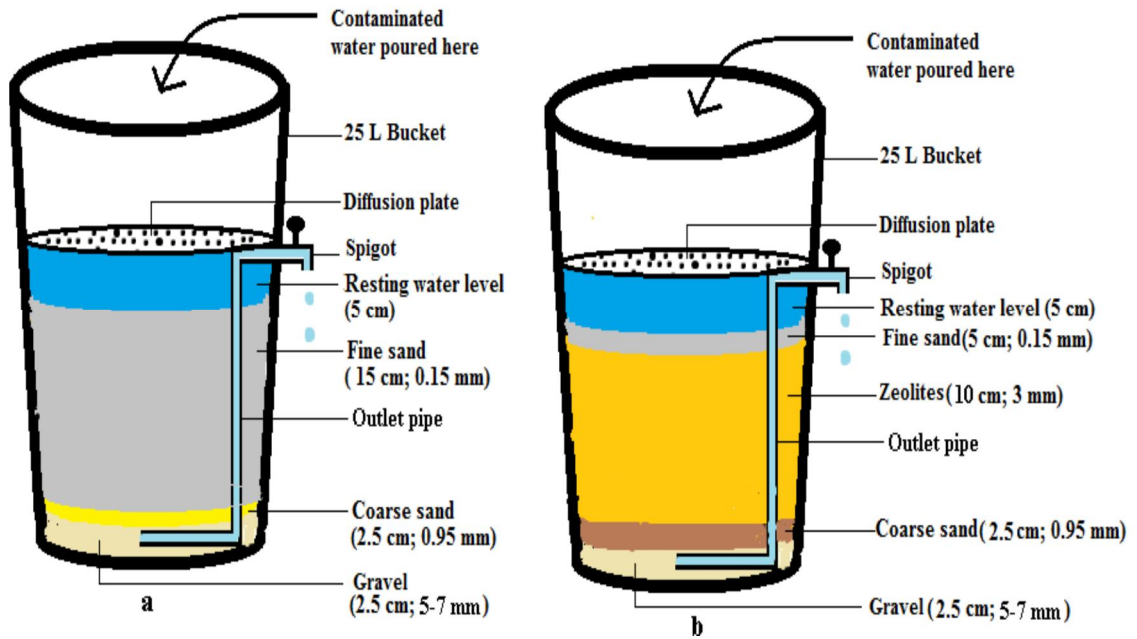


Figure 11. Biosandfilters. (Socelyre et al, 2012)

### 5.3.2 Bucket Filter (BF)

A bucket filter consists of layer of fine sand and gravel inside bucket. First the water contaminated by *E-coli* type bacteria passes through fine sand and then it also passes thorough gravel. As the bottom of the bucket is perforated water will collect in another bucket. All the materials needed to make this filter are usually easy to obtain. The typical structure of the filter is illustrated below in figure 12.

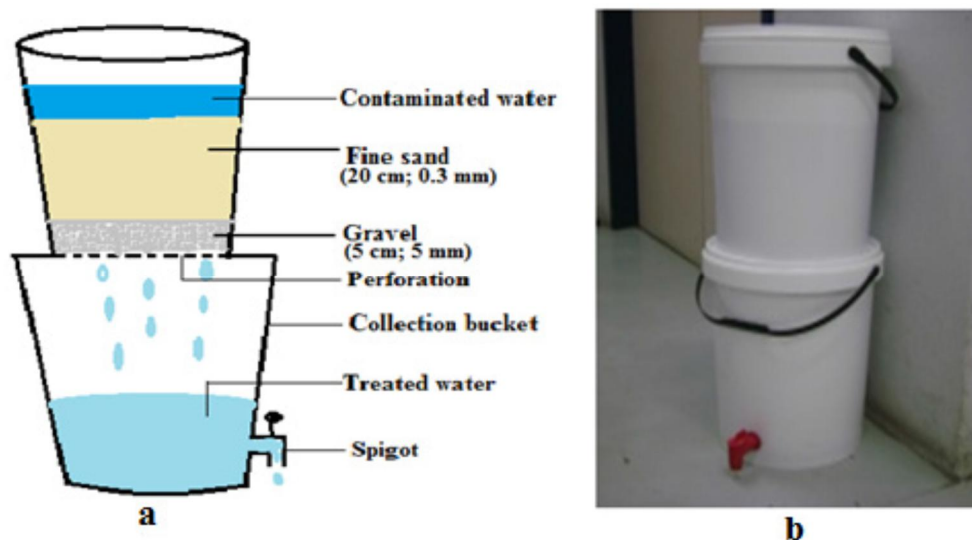


Figure 12. Bucket Filters (Int. J. Environ. Res. Public Health 2012)

#### 5.4 Lime removal technology

Normally the hardness of water is measured in GPG (Grains per Gram), ppm, mg/L, mmol/L. Rain water does not contain any hardness. An accepted level of hardness is from 1 to 10 GPG.

It was noted during the field visit that some of the schemes almost failed within short period of time due to the lime blockages problem in the pipelines. In some schemes WUSC member tried to repair the whole pipeline from the source till the intake; which shows that the schemes had totally failed and the sufficient attention had not been paid to getting rid of lime also people had not been use the technology needed to remove the lime from pipe lines. Table 14 shows commonly used technology to remove lime from water.

Table 16. Commonly used technology to remove lime from water (Odell, 2010)

technology to remove lime				
Filtration	Membrane process	Ion exchange	Chemical disinfection	Precipitation
This process is not applicable	Reverse osmosis	Cat ion exchange	This process is not applicable	Excess lime softening
	Nano filtration			Pellet softening

The available lime removal technology which could be used in the relative scheme is described below.

#### 5.4.1 Aeration method

In aeration method, lime is reacted with oxygen, and the resulting layer will be sediment in a tank (Lindedahl, 2013). Then lime will be removed by cleaning the intake every month depending upon the lime quantity. Figure 12 shows the typical method of removing lime from the water supply.

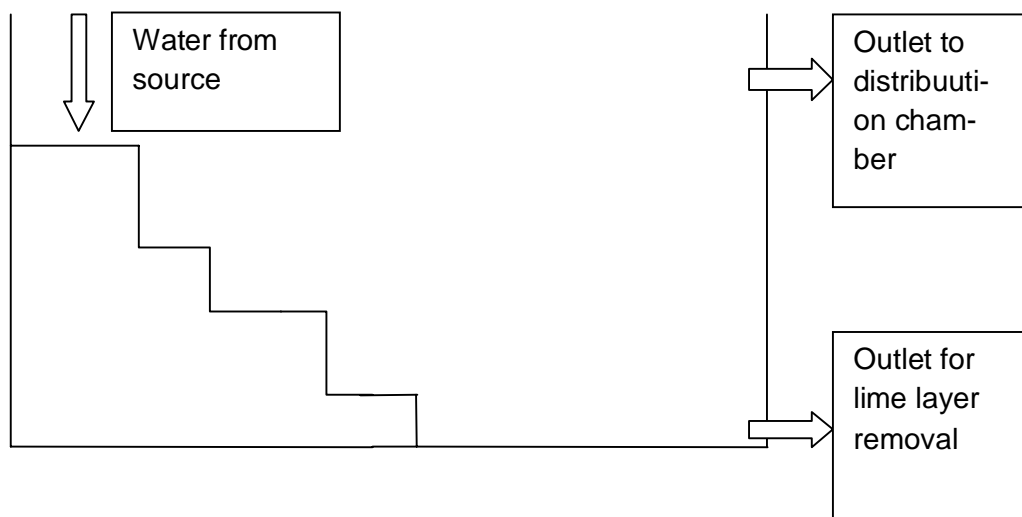


Figure 12. Typical method to remove lime from water supply systems

The method has four stages:

1. First of all the lime quantity in the source needs to be measured in order to design the intake.

2. From the source of water till intake there should be a stair or ladder-like structure by means of water is sprayed with the air.
3. Sprayed water has to kept stable in intake for a while, So that aerated calcium oxide will make the layer at the bottom of the intake.
4. Then lime is deposited at the bottom of the intake tank needs to be cleaned up on a regular basis.

#### 5.3.1.1 Drawbacks of this technology

During the initial period intake has to be designed in a proper way that might need some professionals' and also it might be difficult to select the proper location for the intake so aeration technology will be quite expensive.

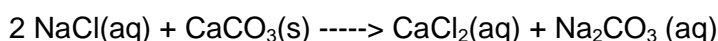
#### 5.4.1.2 Summary

Most of the schemes which have lime problems are gravity flow schemes so water was brought out from source. And aeration technology is considered as an excellent available technology for the RWSSP schemes which have the lime problems.

#### 5.4.2 Zeolite technology

In zeolite technology salt is used to reduce the level of lime. In order to use this technology, the quantity of lime contained in water and the volume of intake need to be known, and then sea salt will be added on regular basis. Commercially available water softener in the market also works under this technology. Basically water softener contains salt (NaCl) pellet or resin that is coated with sodium chloride. (Himalayan Times, 2013)

Chemical reaction is presented below:



(Salt)

(Lime)



Zeolite technology is quite an expensive technology. But it is also appropriate technology to use in RWSSP-WN schemes.

#### 5.4.3 Use of diluted hydrochloric acid

In the diluted hydrochloric acid method water will be made acidic in intake and passed through the pipelines, which removes all the lime scale from the pipes. (Lindedahl, 2013) Diluted HCl can be used in most of the schemes for lime removal from distribution pipelines. HCl is added in the intake manually and the mixture is passed through the pipelines. This solution removes the lime deposition from the pipelines. Depending upon the amount of lime, the process has to be repeated on the regular basis, for example once in a month. The chemical reaction of this process is as below:



*(Metal carbonate) reacting with acid gives salt, water and carbon dioxide.*

#### 5.4.4 Magnetic treatment methods

Another method to remove the lime is by using a magnet. In this method water is passed through a magnetic field. With this method Lime scale will be reduced. Typical method of this technology has been shown in figure bellow. (Gabielli et al, 2001)

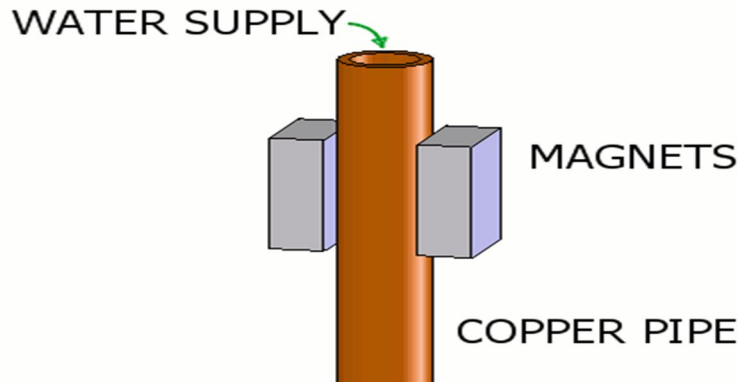


Figure 13. Typical method to remove the lime using magnet. (K&J Magnetics, n.d.)

## 6 Conclusion and recommendations

### 6.1 Conclusion

The essential steps in the protection of water schemes from existing as well as possible environmental threats comprise (i) identification of existing as well as possible environmental problems; (ii) Preparation of possible mitigation measures/action plan, and (iii) execution of the mitigation measures/action plan to protect the area against possible threats caused by the changes to ensure the sustainability of the scheme. The identification of such existing as well as possible environmental threats should be done during the feasibility study of the scheme and the cost of mitigation measures identified should be included in the detailed design estimate of the scheme. Thus, the estimated cost for mitigation measures should be implemented and monitored by the responsible authority (DDC/VDC) during the implementation phase. The design estimate of the scheme should not be approved, if the mitigation measures for sustainability of the schemes in terms of environmental conservation, source/catchments protection are not properly addressed.

Hence, the environmental protection measures should not be considered in isolation from the scheme implementation; rather, they should be in-built in the scheme design and duly implemented along with the construction of structures. Moreover, such consideration for environmental threats also supports to ensure minimization of the water quality issues and helps to achieve the Water Safety Plan (WSP) of the scheme. The Water Users' and Sanitation Committees (WUSCs)/users should also be oriented properly to create awareness on environment conservation, source depletion, source protection, climate changes, water quality, and water safety plan.

RWSSP-WN has duly focused the need on the identification and mitigation of possible environmental threats in the schemes along with the environment conservation/protection; however, in practice this environmental aspect is observed either undermined or overlooked during the design estimate preparation of the scheme and its implementation. So this aspect needs to be improved in the future.

### 6.1.1 Limitations

The following were the major challenges and limitations encountered during the thesis project:

- Due to the unstable political situation, there were frequent strikes organized by different political parties, during such periods, all vehicles and office work was hampered, which made it impossible to perform field work and data collection.
- As some of the selected schemes are also quite far from the district headquarters, this visit took comparatively more time (some time only one scheme could be visited a day).
- Similarly, as it was the rainy season and peak farming time, most of the community people were busy with their agricultural activities, so it was not possible to arrange a mass meeting of all users during the community visits. However, during the research period of the thesis project, all possible support from the RWSSP-WN (including vehicle support for field visit) and the user's community was received.

## 6.2 Recommendations

Following are the major recommendations suggested based on the discussion/interaction with the WUSCs/users and observation of the selected sample schemes visited during the thesis project. Conservation activities like tree plantation and forest management near the scheme area should be promoted in order to control the natural calamities such as landslides and soil erosion. Also, dams can be constructed to control the runoff water to the source. A budget for such activities should be included in the scheme costs.

- Community mobilization and community level trainings should be provided during the implementation phase to create awareness on source/catchment protection and other environmental management issues for example source depletion and climate change.
- At the moment there were no 'recharge ponds', so promotion of recharge ponds at the hill tops need to be carried out to resolve the source depletion/protection issue and to ensure overall environment/catchment conservation.
- Community/users should be encouraged towards the promotion and use of alternative energy (e.g. Bio-gas and improved cooking stoves) to minimize the existing pressure on the forest of the catchment area. Linkages for the promotion of such activities should be established with related organizations/agencies.
- The use of High Density Polyethylene (HDP) pipes left exposed at the crossings, in rocky and forest areas, and in difficult zones should be discouraged to avoid damage from forest-fires or other vandalism. Galvanized Pipe (GI) pipes should be provisioned in such critical areas/difficult zones.
- As the schemes of Terai region (at Chure foot-hills) are highly affected by lime encrustation, so it is strongly recommended that BAT (Best Available technique) for lime removal should be used in the source and other structures before passing through the distribution pipe lines.

- In case of electrical lifting, even though earthing has been provided, it would be safer it needs to be providing a lightning arrester to save the transformer and pumps from being damaged by thunder/lightening.
- Water quality testing should be made mandatory and performed at least twice in each scheme (before and after implementation phase or during dry and rainy season). Appropriate mitigation measures also need to be carried out where the water quality is observed contaminated (existence of ecoli, coliform or other bacteriological contamination).
- WUSCs/users should be made aware of the need for regular cleaning of the source and other structures to ensure water safety.
- The WUSCs/users need to be properly oriented and supported for the establishment of future O&M Plan and its execution, system management, institutional strengthening and capacity building. Water safety plan along with the strong O&M system need to be carried out for the water safety and long term sustainability of the scheme. To this end, focus should be placed on implementing the consolidation phase (post construction) activities in the completed schemes.
- The interviewees speculated that in some WUSC schemes there were financial irregularities; therefore, it is strongly recommended that such schemes should be properly inspected and the project management should properly control the financial activities of the schemes.

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## 8 Appendices

## Field Visit Report of Myagdi and Baglung

Date of Visit: 11 – 14 July 2012

### Visit Team Members:

Krishna Chauhan:	Student
Bimal Sharma:	OMMS
Chandra Bista:	WASH Advisor (accompanied during scheme visit in Myadi)
Uddhav Bhattarai:	WASH Advisor (accompanied during scheme visit in Baglung)

### Objective of the Visit:

- To assess the environmental sustainability of completed DWS schemes (visit in sample schemes as a part for the study on Environmental Sustainability for Intern Study)
- To assess the existing operation and maintenance status of completed schemes including future O&M Plan of the WUSCs (as a part of post construction follow-up)
- To carry out follow-up of the on-going Technical and Operational Audit in the districts
- On-site support to DDCs as needed

To meet the above objectives, the team selected few sample schemes (2 each in Myagdi; and Baglung) for detailed study. Apart from observation of source/catchment area and scheme structures, the team also held interaction with WUSC members/users and discussed on several issues. The team also provided on-site orientation to the WUSC/community on the major areas where the improvements are needed. Finally, a debriefing meeting was held with LDO/DTO, WASH Unit staff and SP members to discuss on some of the key findings.

As a remarkable achievement, it was known that DDC Baglung has also started providing the amount of DDC contribution to the respective WUSCs. This year in total Rs. 4, 61,000 has been allocated and paid to various WUSCs completed this year. During debriefing meeting LDO informed that the payment of DDC contribution will be continued to the remaining WUSCs as well.

Regarding **Technical and Operational Audit**, the consultant team has already completed their visits in three VDCs of Myagdi and still working in rest VDCs. But due to massive landslide the road to Dana VDC has been completely damaged (even the foot trails), so they could not visit this VDC and requested for replacement.

**The following are the key findings of the visit.**

**A. Myagdi (visited on 11-12 July, 2012)**

Schemes Visited/VDC	Positive Observations	Areas for Improvement
<p><b>1. Hande Bhir Krosebagar Scheme</b></p> <p>Arman VDC</p> <p>New Gravity scheme</p> <p>Total 23 HHs with 150 population</p> <p>Janajati 12 HHs; Dalit 6 HHs; Brahmin/Chhetri 5 HHs</p>	<ul style="list-style-type: none"> <li>The scheme is ready for completion (within a week). Only CC and tap connection is left.</li> <li>Construction quality and workmanship of structures are observed good.</li> <li>WUSG is registered; and WUSC is active (Total 9 members – 4 Female; 1 dalit)</li> <li>WUSC has maintained all relevant documents, books of accounts etc.</li> <li>Training on post-construction; Book keeping; and MW are imparted to WUSC/MW</li> <li>Public Hearing has been completed</li> <li>Display Board has been main-</li> </ul>	<ul style="list-style-type: none"> <li>Final Public Audit has to be carried out</li> <li>WUSC has not yet decided any modality for future O&amp;M system; water tariff collection not started; and no mobilization and payment started to MW. So they need to be oriented and supported to decide future O&amp;M system and practice on it.</li> <li>WUSC/MW needs on-site hands-on support as refresher training on post construction and O&amp;M management</li> <li>WUSC/MW has to be made aware on water safety plan (WSP) and water quality</li> </ul>

	<p>tained properly with detailed scheme information (could be example for others)</p> <ul style="list-style-type: none"> <li>• WUSC has raised up-front O&amp;M fund and deposited in Bank A/C (Rs. 5,698).</li> <li>• WUSC has also collected and deposited up-front 20% of community contribution amount (Rs. 17400).</li> <li>• Till date WUSC has received only 1<sup>st</sup> installment payment (Rs. 3,87,507) and requested for remaining payments (2<sup>nd</sup> and final)</li> <li>• MW selected (2 nos – one Female; one dalit Male)</li> <li>• There are one intake/CC, one RVT and 7 public tap stands built</li> <li>• Existing as well as possible environmental threats observed at catchment area/source as there is landslide near the source (landslide active since last 6 years)</li> <li>• As the source tapping point is located at very difficult zone and no adequate space, the intake/CC is constructed around 100 mtr down the source.</li> </ul>	<p>testing</p> <ul style="list-style-type: none"> <li>• DDC/VDC contribution need to be provided to WUSC as per design/estimate</li> <li>• The 2<sup>nd</sup> and final installment payments has to be provided to WUSC</li> <li>• WUSC needs to be oriented to hold regular formal meetings to discuss different issues (till date only 2 formal meetings has been held)</li> <li>• Following technical problems need to be addressed properly for scheme sustainability: <ul style="list-style-type: none"> <li>- During discussion as the WUSC members mentioned the intake/tapping point should be placed in safe location under rocky part.</li> <li>- System for proper diversion of run-off water should be provided at intake/CC structures</li> <li>- Masonry wall need to be provided at upper part of CC, where slight erosion has been observed</li> <li>- Completion of intake/CC and Water connection at tap stands need to be completed</li> <li>- Fencing work at In-</li> </ul> </li> </ul>
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		<p>take/RVT need to be completed</p> <ul style="list-style-type: none"> <li>- The adequate depth (90 cm) of the transmission main need to be confirmed. In some stretches it was observed not maintained.</li> </ul>
<p><b>2. Jukepani Odare Scheme</b></p> <p>Bhakimlee VDC</p> <p>New Gravity scheme</p> <p>Total 18 HHs with 114 population</p> <p>Majority Janajati HHs</p>	<ul style="list-style-type: none"> <li>• The scheme is completed since last three years and functional.</li> <li>• Construction quality and workmanship of structures are observed good.</li> <li>• WUSG is registered; and WUSC is active (Total 9 members–3 Female)</li> <li>• WUSC is holding regular formal meeting at least once a month when they also used to collect monthly water tariff.</li> <li>• WUSC has maintained all relevant documents, books of accounts etc.</li> <li>• Training on post-construction; Book keeping; and MW are imparted to WUSC/MW</li> <li>• Public Hearing and Final Public Audit has been completed</li> <li>• Display Board has been maintained properly with detailed scheme information.</li> <li>• WUSC has raised up-front O&amp;M fund and deposited in Bank A/C (Rs. 6.957). Current</li> </ul>	<ul style="list-style-type: none"> <li>• Currently the WUSC Chairperson has been actively involved in O&amp;M activities and MWs are not mobilized and paid. So they need to be oriented for proper mobilization of MWs in O&amp;M work.</li> <li>• WUSC/MW needs on-site hands-on support as refresher training on post construction and O&amp;M management to make them capable in regular repair and maintenance work.</li> <li>• WUSC/MW has to be made aware on water safety plan (WSP) and water quality testing</li> <li>• Following minor technical problems need to be corrected: <ul style="list-style-type: none"> <li>- There is possibility to enter run-off water inside intake as the Intake cover (GI sheet) is damaged. If possible suggested to</li> </ul> </li> </ul>

	<p>balance in O&amp;M fund is Rs. 14,000 of which Rs. 11,000 has been mobilized as loan (2% interest) for IGA.</p> <ul style="list-style-type: none"> <li>• WUSC has received all payments from DDC/VDC as per the design/estimate.</li> <li>• MW has been selected (2 nos – one Female).</li> <li>• WUSC is practicing to collect Water tariff (Rs.25/HH/month) and the total collection is Rs.500/ month.</li> <li>• There are one intake, one RVT and 6 public tap stands built</li> <li>• No existing or possible environmental threats observed at catchment area/source and for other structures</li> <li>• Fencing work done properly at RVT.</li> <li>• Gabion wall has been provided properly in intake and RVT structures for necessary protection.</li> </ul>	<p>provide concrete slab instead of GI sheet.</p> <ul style="list-style-type: none"> <li>- Boulder packing need to be provided above intake to protect the water quality.</li> <li>- GI pipes or steel wire support needed to be used in stream crossing (around 5 mtr.) in the distribution pipeline where at present HDP pipe is used.</li> <li>- The exposed HDP pipe (around 1 mtr) at village road need to be buried properly to protect it damaging from vehicles.</li> </ul> <ul style="list-style-type: none"> <li>• WUSC should be oriented on the removal of shrub/weeds around the intake and RVT areas regularly. The boulder packing provided inside intake also needs to be cleaned regularly.</li> </ul>
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### Some Photographs of Handebhir Scheme, Myagdi



**Photo 1:** Source Tapping Point near landslide area  
construction, sliding area observed

**Photo 2:** Intake under



**Photo 3:** View of RVT, Fencing to be completed  
connection to be provided

**Photo 4:** Tap stand,



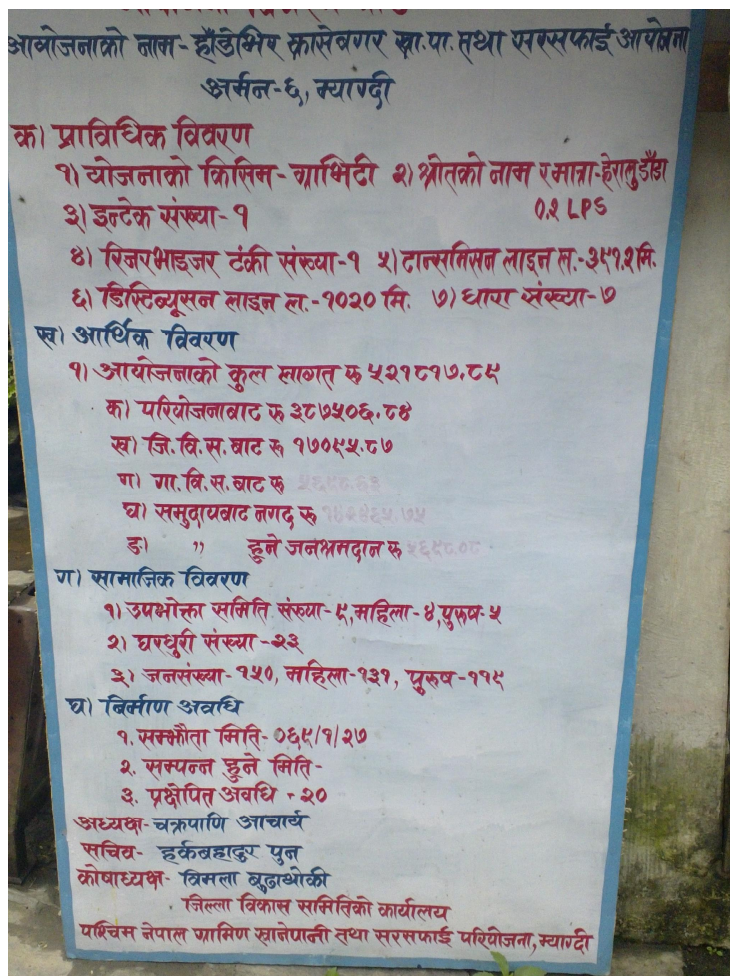


Photo 5: View of Display Board

### Some Photographs of Jukepani Odare Scheme, Myagdi



**Photo 1:** View of Intake and catchment Area  
take; cleaning work needed

**Photo 2:** View inside In-



**Photo 3:** View of RVT; regular cleaning needed  
cover; need to be changed

**Photo 4:** View of Intake



**Photo 5:** HDP pipe at crossing, needs proper support  
village road; to be properly covered

**Photo 6:** Exposed pipe at

**Baglung (visited on 13-14 July, 2012)**

Schemes Visited	Positive Observations	Areas for Improvement
<p><b>3. Jukepani Scheme</b></p> <p>Bihunkot VDC</p> <p>New Gravity scheme</p> <p>Total 77 HHs with 441 population</p> <p>All dalit HHs (B.K. and Damai)</p>	<ul style="list-style-type: none"> <li>• The scheme is completed since last 6 month and functional</li> <li>• Construction quality and workmanship of structures are observed good.</li> <li>• WUSG is registered; and WUSC is active (Total 13 members – 4 Female)</li> <li>• WUSC has maintained all relevant documents, books of accounts etc.</li> <li>• Training on pre-construction; procurement and quality inspection; Book keeping; and MW are imparted to WUSC/Treasurer/MW</li> <li>• Public Hearing and Mid-term Public Audit has been completed</li> <li>• Display Board (in flex) has been maintained</li> <li>• WUSC has raised up-front O&amp;M fund and deposited in Bank A/C (Rs. 19151). Current balance in O&amp;M fund is Rs. 20,000. The WUSC is planning to mobilize this fund as loan for IGA.</li> <li>• VDC has provided only part of their contribution to WUSC (Rs. 15000)</li> </ul>	<ul style="list-style-type: none"> <li>• Post-construction training and Final Public Audit has to be carried out</li> <li>• WUSC has not yet decided any modality for future O&amp;M system; water tariff collection not started; and no mobilization and payment started to MW. So they need to be oriented and supported to decide future O&amp;M system and practice on it.</li> <li>• WUSC/MW needs on-site hands-on support as refresher training on O&amp;M management</li> <li>• For durability the Display Board should be prepared in GI sheet instead of flex and scheme details should be included</li> <li>• WUSC/MW has to be made aware on water safety plan (WSP) and water quality testing</li> <li>• DDC/VDC contribution need to be provided to WUSC as per design/estimate</li> <li>• Following minor technical problems need to be corrected: <ul style="list-style-type: none"> <li>- Boulder packing need to be done properly at 2<sup>nd</sup> intake with system for proper diversion of run-off water</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• MW selected (2 nos – one female)</li> <li>• Gabion wall provided in 1<sup>st</sup> intake to protect it from possible threat.</li> <li>• Boulder packing done in 2<sup>nd</sup> intake.</li> <li>• GI pipe with proper support provided in crossing (about 8 mtr span)</li> <li>• No existing or possible environmental threats observed at catchment area/ sources and for other structures</li> <li>• In total 3 sources are tapped; three intakes; two DC/CCs; two RVTs and 17 public tap stands built</li> <li>• Fencing work done properly at Intake and RVTs (as needed)</li> </ul>	<ul style="list-style-type: none"> <li>- air locking observed at some tap stands</li> <li>- main hole cover at CC/DC and intake needs to be adjusted properly for water safety and easy operation</li> <li>- overflow pipes at structures need to be extended adequately for the safety of structures</li> <li>• WUSC should be oriented on the removal of shrub/weeds around the intake and RVT areas regularly</li> </ul>
<p><b>4. Sahsradhara Scheme</b></p> <p>Bihunkot VDC</p> <p>New Gravity scheme</p> <p>Total 110 HHs with 748 population with Brahmin/Chhetri in majority</p>	<ul style="list-style-type: none"> <li>• The scheme is completed since last 5 month (2068/11/10) and functional</li> <li>• Construction quality and workmanship of structures are observed good.</li> <li>• WUSG is registered; and WUSC is active (Total 11 members – 4 Female)</li> <li>• WUSC has maintained all relevant documents, records, books of accounts etc.</li> <li>• Training on pre-construction; procurement and quality in-</li> </ul>	<ul style="list-style-type: none"> <li>• Post-construction training and Final Public Audit has to be carried out</li> <li>• WUSC has not yet decided any modality for future O&amp;M system; water tariff collection not started; and no mobilization and payment started to MW. So they need to be oriented and supported to decide future O&amp;M system and practice on it.</li> <li>• WUSC/MW needs on-site hands-on support as refresher training on O&amp;M management</li> </ul>

	<p>spection; Book keeping; and MW are imparted to WUSC/Treasurer/MW</p> <ul style="list-style-type: none"> <li>• Public Hearing and Mid-term Public Audit has been done</li> <li>• Display Board (in flex) has been maintained</li> <li>• WUSC has raised Rs. 30,772 as up-front O&amp;M fund and deposited in Bank A/C. The current balance in O&amp;M A/C is around Rs. 1,00,000. The WUSC is planning to mobilize the fund as loan soon for IG Activities.</li> <li>• VDC has provided their contribution to WUSC (Rs. 22,000)</li> <li>• DDC has also provided Rs. 84,000 as DDC contribution</li> <li>• MW selected (2 nos – one female)</li> <li>• There are one intake; two RVTs and 35 public tap stands built</li> <li>• Gabion wall provided in the intake to protect it from possible flood (intake located close to stream)</li> <li>• GI pipe is used in crossings (3 areas)</li> <li>• No existing or possible environmental threats observed at catchment area/ sources, RVTs and at other structures</li> </ul>	<ul style="list-style-type: none"> <li>• For durability the Display Board should be prepared in GI sheet instead of flex and scheme details should be included</li> <li>• WUSC/MW has to be made aware on water safety plan (WSP) and water quality testing</li> <li>• Following minor technical problems need to be corrected: <ul style="list-style-type: none"> <li>- Boulder packing need to be done properly at intake with system for proper diversion of run-off water</li> <li>- air locking observed at some tap stands</li> <li>- Water connection has to be provided immediately for the two Tap Stands constructed at Janajati cluster (some minor dispute need to be solved)</li> </ul> </li> <li>• WUSC should be oriented on the removal of shrub/weeds around the intake and RVT areas regularly</li> <li>• WUSC should be oriented to use the overflow water for other purposes such as animal feeding, irrigation etc. or connect the overflow water in the distribution system.</li> </ul>
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	<ul style="list-style-type: none"><li>• The sites for RVTs are selected properly (safe locations)</li><li>• Main hole cover at RVTs are provided properly for water safety and easy handling</li><li>• Overflow pipes at RVTs are provided properly</li><li>• Fencing work done properly at RVTs (Brick wall support in front part also provided in 2<sup>nd</sup> RVT)</li></ul>	
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### Some Photographs of Sahasradhara Scheme, Baglung



**Photo 1:** View of 1<sup>st</sup> Intake and catchment Area  
Boulder packing at 2<sup>nd</sup> Intake



**Photo 2:**



**Photo 3:** View of DC; Manhole cover properly fixed  
RVT; cleaning work needed



**Photo 4:** View of RVT; cleaning work needed



**Photo 5:** GI crossing from 1<sup>st</sup> Intake of Display Board (prepared in flex)



**Photo 6:** View of Display Board



**Photo 6:** After completion of water scheme users' are involved in the Construction of community building using the same modality



### Some Photographs of Sahasradhara Scheme, Baglung



**Photo 1:** View of 1<sup>st</sup> Intake and catchment Area  
good construction quality and fencing

**Photo 2:** 1<sup>st</sup> RVT;



**Photo 3:** 2<sup>nd</sup> RVT; good construction quality and fencing  
View of a functional Tap Stand

**Photo 4:**



**Photo 5:** Display Board in flex; Need to be prepared in GI sheet for durability

And Information on Technical Details should also be included.

### Field Visit Report of Syangja and Rupandehi

Date of Visit: 19 – 22 July 2012

#### Visit Team Members:

Krishna Chauhan : Student

Bimal Sharma : Operation and Maintenance Management Specialist (OMMS)

Sujana Adhikari : WSS Engineer (accompanied during scheme visit in Syangja)

Chhanda Bikram Pandey : WSST (accompanied during Scheme Visit in Syangja)

Arjun Sah : WASH Unit Chief (accompanied during scheme visit in Rupandehi)

Baburam Nepal : WSST (accompanied during scheme visit in Rupandehi)

#### Objective of the Visit:

- To assess the environmental sustainability of completed DWS schemes (visit in sample schemes as a part of study on Environmental Sustainability for Intern Study)
- To assess the existing operation and maintenance status of completed schemes including future O&M Plan of the WUSCs (as a part of post construction follow-up)
- To carry out follow-up of the on-going Technical and Operational Audit in the districts
- On-site support to DDCs as needed

To meet the above objectives, the team selected few sample schemes (2 schemes in Syangja and 3 schemes in Rupandehi) for in-depth study. Apart from observation of source/catchment area and scheme structures, the team also held interaction with

WUSC members/users and discussed on several issues. The team also provided on-site orientation to the WUSC/community on the major areas where the improvements are needed. Finally, a debriefing meeting was held with DTO and WASH Unit staff to discuss on some of the key findings.

Regarding **Technical and Operational Audit**, the consultant team has already completed their visits in all selected sample schemes of Rupandehi; and two schemes of Syangjai. Currently the team is working in Kapilbastu district.

**The following are the key findings of the visit.**

**B. Syangja** (visited on 19 - 20 July, 2012)

Schemes Visited/VDC	Positive Observations	Areas for Improvement
<p><b>5. Dagdi Bazar Water Supply Scheme</b></p> <p>Kyakmi VDC (ward nos 1, 2 and 9)</p> <p>Gravity scheme - New</p> <p>Total 62 HHs with 410 population</p> <p>39 Janajati; 17 dalit; and 6 Brahmin /Chhetri HHs</p>	<ul style="list-style-type: none"> <li>• The scheme is completed and functional since one and half year.</li> <li>• Construction quality and workmanship of structures are observed good.</li> <li>• Scheme is constructed under yard connection system (tap connection to each HH), which seems to be more sustainable.</li> <li>• WUSG is registered; WUSC is active (Total 9 members – 4 Female; 2 dalits)</li> <li>• WUSC has maintained all relevant documents, books of accounts etc. WUSC has also managed their “Office Room” with some furniture (chairs, still cupboard, display materials etc)</li> </ul>	<ul style="list-style-type: none"> <li>• WUSC/MW needs additional on-site hands-on support as refresher training on post construction and O&amp;M management</li> <li>• WUSC/MW need to be made aware on water safety plan (WSP) and water quality testing</li> <li>• Existing environmental threats observed at catchment area/ source. There is agriculture land above source where pesticides and chemical fertilizers are being used; which indicates possibility of water contamination. So appropriate protection measures need to be taken.</li> </ul>

	<ul style="list-style-type: none"> <li>• WUSC has formulated and practicing very well and strict rules for O&amp;M management (water tariff collection). They are charging minimum NRs 50 for water use up to 15 unit; and above that Rs. 5 for each additional unit. They are charging Rs. 25000 for connection charge which includes the cost of meter and only 3 mtr pipe) from distribution line.</li> <li>• WUSC has printed and distributed “tariff card” to all households; they have also printed “tariff collect bill/receipt”; and well maintained users’ ID to each HH (in metal plate)</li> <li>• WUSC has received training on post-construction; Book keeping; and MW</li> <li>• WUSC has received all payments from DDF including the amount of DDC and VDC contributions.</li> <li>• Public Hearing, Mid-term and final public audits have been completed</li> <li>• Display Board has been maintained properly with detailed information and scheme lay out plan (a good example for others)</li> <li>• WUSC has raised up-front O&amp;M fund and deposited in Bank A/C (Rs. 71,618). The current balance</li> </ul>	<ul style="list-style-type: none"> <li>• As known from users the water quality testing (using field test kit) prior to scheme construction had shown the possibility of ecoli or other contamination. Hence, water quality testing (lab testing) needs to be carried out to identify possible contamination and need to take appropriate mitigation measures.</li> <li>• Following technical problems need to be addressed properly for scheme sustainability:             <ul style="list-style-type: none"> <li>- About 12 meters of GI pipe need to be replaced at intake where currently HDP pipe is used and exposed (at rocky area) to prevent it from possible threats such as forest fire or vandalism.</li> <li>- Gabion wall around the intake/CC need to be raised up to adequate height.</li> <li>- Due to land (hill) excavation for house construction at the distribution line, around 6 meter HDP pipe is exposed and hanging since last 4 months. Hence, this need</li> </ul> </li> </ul>
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	<p>in this a/c is Rs. 1,25,000. WUSC has deposited this fund in Dagdi Cooperative with 7% interest/annum.</p> <ul style="list-style-type: none"> <li>• They are collecting in total around Rs. 2400 as monthly water tariff from users.</li> <li>• MW (Mr. Ser Bdr. Gotame) has been selected and mobilized. WUSC is paying Rs. 1500/month to MW for his service. MW is also involved in meter reading and water tariff collection. MW possesses all necessary tools.</li> <li>• WUSC is holding regular meeting at least once in each month.</li> <li>• There are one intake/CC, one RVT (16 cum); and 62 private connections.</li> <li>• Barbed wire fencing provided properly around the intake and RVT structures.</li> <li>• Gabion wall has been provided at lower part of intake to protect it.</li> <li>• Boulder packing has been done properly at the intake/CC. Man-hole cover at intake seems good (properly fixed)</li> </ul>	<p>to be provided proper support or the pipe line alignment should be changed at safe location.</p> <ul style="list-style-type: none"> <li>- Due to critical head difference, the RVT (Ferrocement tank) is constructed above the ground; hence proper soil cover/filling and support need to be provided around the RVT structure.</li> <li>• WUSC should be oriented properly for regular shrub removal and cleaning around RVT and intake structures.</li> <li>• WUSC should be oriented to mobilize the part of O&amp;M fund as loan in the community for Income Generation activities.</li> </ul>
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**Some Photographs of Dagdi Bazar Scheme, Syangja**



Photo 1: Intake/CC; source to be protected from possible contamination needs proper support/backfilling and cleaning around it



Photo 2: RVT



Photo 3:- Tap constructed by a HH as per choice

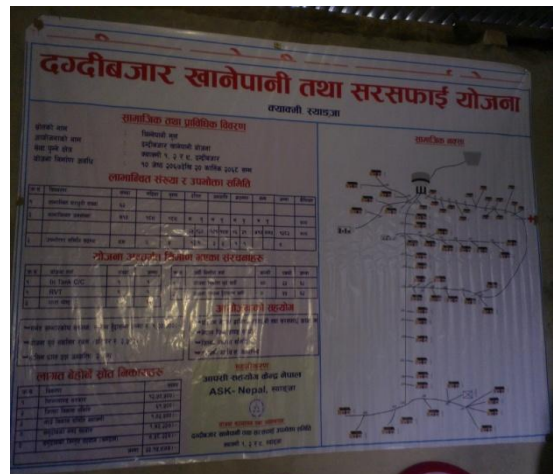


Photo 4: - Display board with in-depth information and lay out plan



**Photo 5:- Household ID No. (Blue Plate) provided to each HH      Photo 6: Pipe exposed and hang ing at distribution line due to land**

### **Institutional Toilet Constructed at Dagdi Bazar Scheme, Syangja**

In Dagdi Bazar Water Supply Scheme area (Kyakmi VDC), an Institutional Toilet is also constructed at Pitambar Higher Secondary School. The toilet consists of 4 urinals and 4 pans for boys and separate urinals and 4 pans for girls. There is also separate toilet constructed for teachers. The total cost of the toilet is around NRs. 800,000 of which DDC has provided only NRs. 200,000 from DDF (WASH Fund) and rest is managed by school, VDC and community contribution.

The construction quality of the toilet is observed good. The toilet has water and hand washing facilities. The toilet is connected with bio-gas plant of 8 m<sup>3</sup>. The school is currently using the produced energy (gas) for cooking (kitchen for teachers) and for lighting (during tuition class). There is also possibility of urine collection separately for vegetable farming.



However, no consideration has been given on disabled – friendly options/facilities. The girl's toilet lacks provision for collecting sanitary pads or cloths during menstruation or incinerator facility. Moreover, the School Management Committee (SMC) has also pay attention to make the regular provision of soap and towel for hand washing. During discussion it was known that there are cases of theft of soap so the school is unable to manage it regularly. But to control this SMC should adopt better supervision and management mechanism.



**Photo 7: View of School Building and Toilet**



**Photo 8: Institutional Toilet (at School) connected with Bio-Gas Plant (8 cum size)**

	Positive Observations	Areas for Improvement
Schemes Visited/VDC		

<p><b>6. Bankatta Water Supply Scheme</b></p> <p>Kewarebhanjyang VDC</p> <p>Electrical Lifting – New</p> <p>Single stage lifting (around 100 mtr elevation)</p> <p>Total pumping around 2 hrs per day</p> <p>Total 135 HHs with 722 population</p> <p>Mixed caste/ethnic groups</p>	<ul style="list-style-type: none"> <li>• The scheme is completed and fully functional since last two years.</li> <li>• Construction quality and workmanship of structures are observed good.</li> <li>• WUSG is registered; WUSC is active (Total 9 members–2 Female; 2 dalits)</li> <li>• WUSC is holding regular formal meeting at least once a month (2<sup>nd</sup> day of each month) when they also used to collect monthly water tariff.</li> <li>• WUSC has properly maintained all relevant documents, books of accounts etc.</li> <li>• Training on pre-construction; procurement and quality inspection; Book keeping; and MW are imparted to WUSC/MW</li> <li>• WUSC has received all payments from DDF including the amount of DDC and VDC contributions.</li> <li>• Public Hearing; Mid-term, and Final Public Audit are completed.</li> <li>• Display Board is maintained properly with detailed scheme information.</li> </ul>	<ul style="list-style-type: none"> <li>• WUSC/MW needs additional on-site hands-on support as refresher training on post construction and O&amp;M management</li> <li>• WUSC/MW has to be made aware on water safety plan (WSP) and water quality testing</li> <li>• Following minor technical problems need to be corrected:             <ul style="list-style-type: none"> <li>- Boulder packing need to be provided at intake to protect the water quality.</li> <li>- Lightening arrester need to be provided to protect transformer and pump from possible lightening threat.</li> <li>- Concrete slab cover is needed at pumping chamber (instead of existing CGI sheet) for water safety.</li> </ul> </li> <li>• WUSC should be oriented on the removal of shrub/weeds around the intake and RVT areas regularly.</li> <li>• WUSC needs support to</li> </ul>
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	<ul style="list-style-type: none"> <li>• WUSC has raised up-front O&amp;M fund and deposited in Bank A/C (Rs. 67,922). Current balance in O&amp;M a/c is around Rs. 1,00,000. The WUSC is planning to mobilize it for IG in future.</li> <li>• WUSC has established coordination and linkages with District Agriculture Office for obtaining support in the promotion of vegetable farming.</li> <li>• Mr. Man Bdr. Khawas has been selected and mobilized as MW/Pump Operator. WUSC is paying Rs. 4000/month to him for his service.</li> <li>• MW/Pump Operator is very active and able to do minor repairs; he is also maintaining pumping log book.</li> <li>• MW posses all necessary tools (except pipe vice for electric work).</li> <li>• Tap Stand committees are formed for each tap; they are also made responsible to collect water tariff for their respective tap.</li> <li>• WUSC is practicing to collect Water tariff (Rs.500/tap/month) and the</li> </ul>	<p>establish linkages with District Agriculture Office to promote commercial vegetable farming as IG activity.</p>
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	<p>total monthly collection is around Rs.15,500. The expense for electric charge is average Rs. 5000/month.</p> <ul style="list-style-type: none"> <li>• There are one intake/CC, two RVTs (20 cum each); and 31 public tap stands (3 in schools) built under this scheme</li> <li>• Barbed wire fencing has been provided in the RVTs.</li> <li>• The manhole covers at RVTs are provided appropriately to prevent possible contamination.</li> <li>• No major environmental threats are observed in the scheme. However, it is known that earlier there were frequent damages occurred in MC at pump house and also case of pump coil damage at one time due to lightning and electricity voltage fluctuation. But now there is no such cases observed. WUSC has changed high grade wire up to transformer, which also stopped such problem.</li> </ul>	
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Some Photographs of Bankatta Scheme, Syangja



Photo 1: Source/catchment; boulder packing needed at intake

Photo 2:

Boulder packing needed area at intake

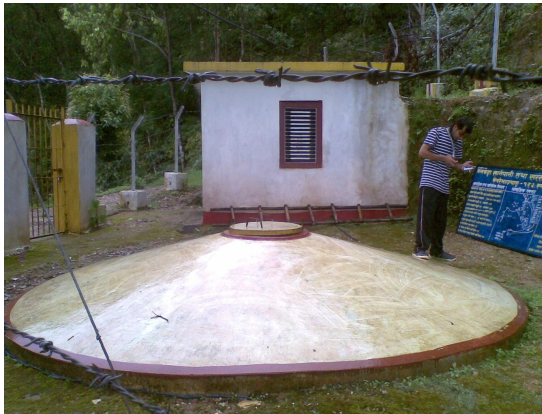


Photo 3: View of 1<sup>st</sup> RVT and Pump House; proper fencing done

Photo 4:

Pumping Chamber which needs concrete slab cover for water safety.



Photo 5: View of Display Board with scheme details

### Institutional Toilet Constructed at Bankatta Scheme, Keware Bhanjyang VDC, Syangja

In Bankatta Water Supply Scheme area (Keware Bhanjyang VDC), an Institutional Toilet is also constructed at Bal Siddhi Higher Secondary School and Bal Siddhi Campus. The toilet consists of 2 urinals for girls (one each for young and adult girls) and 2 pans for girls; and separate urinals and 2 pans for boys. There is also separate toilet constructed for teachers. The total cost of the toilet is around NRs. 600,000 of which DDC has provided only NRs. 200,000 from DDF (WASH Fund) and rest is managed by school, VDC and community contribution.

The construction quality of the toilet is observed good. The toilet has water and hand washing facilities. There is provision of soap for hand washing. However, during construction of toilet no consideration has been given on disabled – friendly options/facilities. The girl's toilet has provision for collecting sanitary pads or cloths during menstruation, but no incinerator facility. There is possibility of urine collection separately for vegetable farming, but at present not collected. The WUSC in association with School Management Committee (SMC) is planning for this to use in vegetable farming.



Photo 6: View of School Building and Toilet



Photo 10: Group Photo with students, teacher and WUSC members Photo 10: Meeting with WUSC members



### C. Rupandehi (visited on 21 July, 2012)

Schemes Visited/VDC	Positive Observations	Areas for Improvement
<p><b>1. Hariyali Water Supply Scheme</b></p> <p>Parroha VDC; Ward no. 5</p> <p>Electrical Lifting scheme – New (single stage pumping). The RVT is located at hill top – around 15 mtr heights.</p> <p>Total 102 HHs with 510 population</p> <p>Majority of Brahmin/Chhetri with Magar and Dalit HHs (Mixed caste/ethnic groups)</p>	<ul style="list-style-type: none"> <li>• The scheme is almost completed with some minor works remaining and functional since one and half months.</li> <li>• Out of total 102 households, 75 HHs have already connected private taps and rest is gradually in connection process.</li> <li>• Construction quality and workmanship of structures are observed satisfactory. Best quality transformer (NEEK) is being used for the scheme.</li> <li>• The average pumping hour is 2 hrs per day and its pumping rate is about 0.005m<sup>3</sup>/Sec.</li> <li>• WUSG is registered; and WUSC is active (Total 9 members – 4 Female)</li> <li>• WUSC is holding regular formal meeting at least once a month or as needed.</li> <li>• WUSC has maintained all relevant documents, books of accounts etc.</li> <li>• Training on Pre – construction; book keeping and MW/Pump Op-</li> </ul>	<ul style="list-style-type: none"> <li>• WUSC/MW needs on-site hands-on support as refresher training on post construction and O&amp;M management to make them capable in regular repair and maintenance work.</li> <li>• WUSC/MW has to be made aware on water safety plan (WSP) and water quality testing</li> <li>• Following minor technical problems need to be corrected: <ul style="list-style-type: none"> <li>- The WUSC have to construct drainage to diverse the runoff water from the hill near RVT. At present the runoff water has exposed the pipeline near RVT as it removed/washed the soil.</li> <li>- Sliding observed at the north part of RVT which need to be protected using masonry wall or using other appropriate</li> </ul> </li> </ul>

	<p>erator provided to WUSC/MW.</p> <ul style="list-style-type: none"> <li>• Public Hearing, Mid-term and Final Public Audit has been completed</li> <li>• WUSC has raised up-front O&amp;M fund and deposited in Bank A/C (Rs. 28,000).</li> <li>• WUSC has received all installments from DDF including DDC contribution. However, they have yet to receive the final installment from VDC.</li> <li>• MW/Pump Operator has been selected and mobilized. WUSC is providing Rs. 2000 monthly to him as his remuneration.</li> <li>• There are one pump house (boring); one RVT (20 cum) and 75 house connections (till date).</li> <li>• WUSC is practicing to collect Water tariff (Rs.100 minimum) for water use up to 10,000 ltr and Rs. 15 extra for each 1000 ltr additional water use.</li> <li>• The WUSC is charging Rs. 5700 for connection charge (excluding the cost of meter, pipe and fittings needed from distribution line) with old households who had provided kind contribution for the scheme; however they are charging Rs. 11,700 with new HHs who has not provided kind contribution.</li> </ul>	<p>measures.</p> <ul style="list-style-type: none"> <li>- Lightning arrester need to be provided to protect transformer and pump from possible lightening threat.</li> <li>• Water quality needed to be tested after construction.</li> <li>• MW/Pump Operator need to be oriented to maintain pumping log book regularly.</li> <li>• WUSC have to complete the site clearance and back filling work around RVT structure.</li> <li>• Display Board with detailed scheme information need to be maintained at the public place for transparency.</li> </ul>
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	<ul style="list-style-type: none"><li>• The WUSC is planning to print and distribute “tariff card” to all households; they are also going to print “tariff bill/receipt”; and going to maintain users’ ID to each HH.</li><li>• No major existing as well as possible environmental threats observed in this scheme.</li></ul>	
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### Some Photographs of Hariyali Lifting Scheme, Rupandehi



Photo 1: View of Boring site and pump House scheme



Photo 2: Transformer for the scheme



Photo 3:- RVT good workmanship; site clearance and backfilling left      Photo 4: Fencing improvement at north part with protection work (masonry wall) needed to stop sliding.

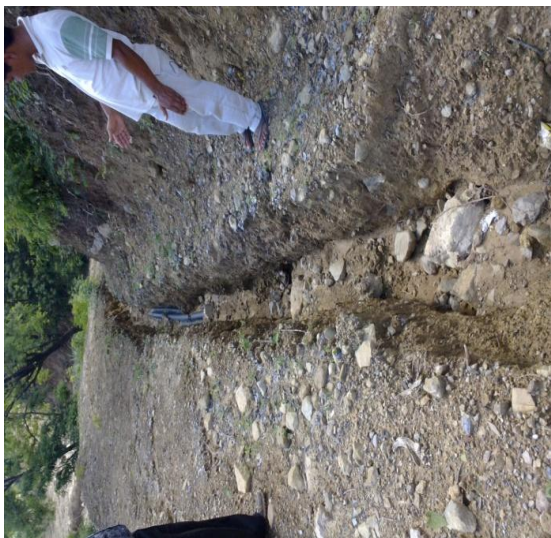


Photo 5: Erosion due to runoff water from hill/drain to be constructed.      Photo 6: Interaction with WUSC Chairperson/users

**Tallo sarantandi Water Supply scheme, Devdaha VDC, Rupandehi**

Schemes Visited/VDC	Positive Observations	Areas for Improvement
<p><b>2. Tallo sarantandi Water Supply scheme</b></p> <p>Devadaha VDC; W. No. 3</p> <p>Gravity Rehabilitation scheme</p> <p>Total 22 HHs with 197 population</p> <p>2 dalits; and rest Magar (Janajati) HHs</p>	<ul style="list-style-type: none"> <li>• The scheme is completed and functional since 3 years.</li> <li>• Construction quality and workmanship of structures are observed good.</li> <li>• WUSG is registered; and WUSC is active (Total 9 members—4 Female)</li> <li>• WUSC has maintained all relevant documents, books of accounts etc.</li> <li>• Training on pre-construction; Book keeping; and MW are imparted to WUSC/MW</li> <li>• Public Hearing; Mid Term and Final Public Audits completed.</li> <li>• WUSC has raised up-front O&amp;M fund and deposited in Bank A/C (Rs. 3,385).</li> <li>• WUSC has received the entire installment from DDF and also the amount of DDC and VDC contribution.</li> <li>• WUSC is collecting Rs. 20 per HH/month as water tariff</li> <li>• MW selected (Male) and mobilized (jointly with the adjoining Mathillo Sarantandi Scheme constructed by Fund Board). WUSC is providing Rs.</li> </ul>	<ul style="list-style-type: none"> <li>• WUSC/MW needs on-site hands-on support as refresher training on post construction and O&amp;M management.</li> <li>• As WUSC Secretary (Female) currently residing at Palpa (for service - teaching), so the WUSC need to be oriented to select a new secretary as soon as possible.</li> <li>• WUSC needs further support to find out reliable/adequate source for the scheme or find out alternative option (such as sharing additional water from Mathillo Sarantandi scheme)</li> <li>• WUSC/MW has to be made aware on water safety plan (WSP) and water quality testing</li> <li>• Following technical problems need to be addressed properly for sustainability: <ul style="list-style-type: none"> <li>- As the scheme is suffering from <b>lime en-</b></li> </ul> </li> </ul>

	<p>400/month to the MW for his remuneration.</p> <ul style="list-style-type: none"> <li>• WUSC meeting is held twice a year or as needed to discuss on different issues.</li> <li>• There are one intake/CC, one RVT and 6 public tap stands built (2 taps added by WUSC latter on for 5 HHs). WUSC is currently planning to upgrade the service level by providing yard connection system (under discussion).</li> <li>• Due to low discharge of previous source during dry season, the WUSC added a new source with temporary alignment. They received 600 mtr HDP pipe from VDC for this work. However, this source is also inadequate for the community during dry season.</li> <li>• No other existing as well as possible environmental threats observed at catchment area/source.</li> </ul>	<p><b>crustation</b>, the WUSC have to be oriented to use <b>BAT (Best Available technique)</b> to remove/ mitigate lime in source, pipeline &amp; other structures to ensure sustainability. Currently most of the pipelines are not buried as the WUSC use to cut the pipes at different stretches and thrash it from time to time to remove lime.</p> <ul style="list-style-type: none"> <li>- System for proper diversion of run-off water should be provided at intake structure to prevent water contamination</li> <li>• Water quality need to be tested.</li> <li>• WUSC should be oriented on the removal of shrub/weeds around the intake/CC and RVT regularly.</li> <li>• WUSC should also be oriented for regular cleaning inside intake (cleaning boulders).</li> <li>• Display Board with detailed scheme information</li> </ul>
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		need to be maintained at the public place for transparency.
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**Some Photographs of Tallo sarantandi Scheme, Rupandehi**



**Photo 1: - Intake structure; needs proper cleaning cleaning and fencing**



**Photo 2: - collection chamber needs proper**



**Photo 5 and 6: Pipelines not buried properly as the users cut and thrash it from time to time to remove lime;**

**Possibility of water contamination observed**



Schemes Visited/VDC	Positive Observations	Areas for Improvement
<p><b>3. Keuli Water Supply scheme</b></p> <p>Devadaha VDC; W. No. 9</p> <p>Gravity Rehabilitation scheme</p> <p>Total 44 HHs with 265 population</p> <p>All Magar (Janajati) HHs</p>	<ul style="list-style-type: none"> <li>• The scheme is completed and functional since 3 years.</li> <li>• Construction quality and workmanship of structures are observed good.</li> <li>• WUSG is registered</li> <li>• The WUSC is recently reformed and active (Total 9 members–4 Female).</li> <li>• WUSC has maintained relevant documents, books of accounts etc.</li> <li>• Training on pre-construction; Book keeping; and MW are imparted to WUSC/MW</li> <li>• Public Hearing; Mid Term and Final Public Audits completed.</li> <li>• WUSC has raised up-front O&amp;M fund and deposited in Bank A/C (Rs. 5,365).</li> <li>• WUSC has received the entire installment from DDF and also the amount of DDC and VDC contribution.</li> <li>• WUSC is collecting Rs. 20 per HH/month as water tariff</li> <li>• MW selected (Male) and mobilized. WUSC is providing Rs.</li> </ul>	<ul style="list-style-type: none"> <li>• WUSC/MW needs on-site hands-on support as refresher training on post construction and O&amp;M management.</li> <li>• WUSC/MW has to be made aware on water safety plan (WSP) and water quality testing</li> <li>• As the scheme is suffering from <b>lime encrustation</b>, the WUSC have to be oriented to use <b>BAT (Best Available technique)</b> to remove/ mitigate lime in source, pipeline &amp; other structures to ensure sustainability. Currently most of the pipelines are not buried as the WUSC use to cut the pipes at different stretches and thrash it from time to time to remove lime.</li> <li>• Water quality need to be tested.</li> <li>• Technical support should be provided to WUSC for changing the system to</li> </ul>

	<p>500/month to the MW for his remuneration.</p> <ul style="list-style-type: none"> <li>• WUSC meeting is held as needed to discuss on different issues.</li> <li>• There are one intake/CC, one RVT and 14 public tap stands. WUSC is currently in process of upgrading the service level by providing yard connections. They already provided such connections to few HHs and rest under discussion.</li> <li>• No other existing as well as possible environmental threats observed at catchment area/source.</li> </ul>	<p>yard connections properly.</p> <ul style="list-style-type: none"> <li>• WUSC should be oriented on the removal of shrub/weeds around the intake/CC and RVT regularly.</li> <li>• Display Board with detailed scheme information need to be maintained at the public place for transparency.</li> </ul>
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**Photo 2: Pipelines almost laid open as the users cut and thrash it from time to time to remove lime**

### Field Visit Report of Tanahun

Date of Visit: 6<sup>th</sup> July 2012

#### Visit Team Members:

Krishna Chauhan	: Intern
Sangita Khadka	: GISMS
Rubika Shrestha	: WASH Engineer (accompanied during scheme visit in Tanahun)

#### Objective of the Visit:

- To assess the environmental sustainability of completed DWS schemes (visit in sample schemes as a part for the study on Environmental Sustainability for Intern Study)
- To assess the existing operation and maintenance status of completed schemes including future O&M Plan of the WUSCs (as a part of post construction follow-up)
- On-site support to DDCs as needed

To meet the above objectives, the team selected two sample schemes in Tanahun for detailed study. Apart from observation of source/catchment area and scheme structures, the team also held interaction with WUSC members/users and discussed on several issues. The team also provided on-site orientation to the WUSC/community on the major areas where the improvements are needed.

In Nabarjung Devi scheme at Babarbhayang VDC the WUSC had not yet received any installment from VDC as their contribution. During discussion, we found that there is

contradiction going on between the WUSC and VDC regarding that contribution amount. As known, VDC had provided dozer facility and managed the road up to intake of the scheme which made the WUSC easy to carry out materials and equipment needed to construct the intake and first pumping station structures. Hence, the VDC don't want pay cash contribution to the WUSC.

Similarly, in Chhatimane scheme of the same VDC (Barbhanjyang), the WUSC has bought quite large area of source land to use that source of water, as the source is located in private land. The WUSC paid around Rs. 70,000 for this. Their money was collected from the user households.

**The following are the key findings of the visit.**

D. **Tanahun** (visited on 6th June, 2012)

Schemes Visited/VDC	Positive Observations	Areas for Improvement
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<p><b>7. Nabarung Devi Scheme</b></p> <p>Barbhanjyang VDC</p> <p>Double stage electric Lifting scheme - new</p> <p>Total 397 HHs with 2375 population</p>	<ul style="list-style-type: none"> <li>• The scheme is ready for completion. Only fencing at intake, RVT and connection to some taps are left.</li> <li>• Construction quality and workmanship of structures are observed satisfactory.</li> <li>• WUSG is registered; and WUSC is active (Total 9 members)</li> <li>• WUSC has maintained all relevant documents, books of accounts etc.</li> <li>• Public Hearing (before agreement) has been completed</li> <li>• WUSC has not received any installments from VDC as their contribution. However, the VDC had provided support to construct road up to the intake.</li> <li>• MW selected - 2 nos.</li> <li>• There are two pumping stations, two RVTs and one intake.</li> <li>• Existing as well as possible environmental threats observed at catchment area/source and landslide above the source due to road construction. There are also possibilities of lightening threats to the transformer.</li> </ul>	<ul style="list-style-type: none"> <li>• Final Public Audit has to be carried out</li> <li>• WUSC has not yet decided any modality for future O&amp;M system; water tariff collection not started; and no mobilization and payment started to MW. So they need to be oriented and supported to decide future O&amp;M system and practice on it.</li> <li>• WUSC/MW needs on-site hands-on support as refresher training on post construction and O&amp;M management</li> <li>• WUSC/MW has to be made aware on water safety plan (WSP) and water quality testing</li> <li>• VDC contribution needs to be provided to WUSC as per their contribution or the valuation of road construction work should be booked as VDC contribution. This needs to be resolved mutually by VDC and WUSC. For this, facilitation needed from DDC/SP.</li> <li>• Display board with detail information need to be maintained in public place for transparency.</li> </ul>
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		<ul style="list-style-type: none"><li>• WUSC needs to be oriented to hold regular formal meetings to discuss different issues.</li> <li>• Following technical problems need to be addressed properly for scheme sustainability:<ul style="list-style-type: none"><li>- Debris collected inside intake structure need to remove immediately and there is need to provide necessary support by masonry wall to control future sliding. The intake also needs slab cover.</li><li>- Fencing work to be done at intake, RVTs and other structures</li><li>- Pipelines at different places need to buried/backfilled properly.</li><li>- Plantation needed around the first pumping station in order to protect from possible landslide.</li><li>- Lightning arrester need to be connected in order to save transformer/pumps possible from lightening.</li><li>- The broken meter ob-</li></ul></li></ul>
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		<p>served at first pumping station need to be changed.</p> <ul style="list-style-type: none"><li>- Proper slab cover is needed for the valve box near 2<sup>nd</sup> pumping station.</li></ul>
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**Some Photographs of Nabarung Devi Water Supply Scheme, Tanahun**





**Photo 1: view of transformer fencing needed**



**Photo 2: 2<sup>nd</sup> pumping station, backfilling &**



**Photo3: Debris inside intake, cleaning and slab needed changed**



**Photo 4: Broken meter need to be changed**



Photo 5: 1<sup>st</sup> pumping station, site clearance and fencing needed due to road construction; protection measure needed.

Photo 6: Sliding near 1<sup>st</sup> pumping station

Schemes Visited/VDC	Positive Observations	Areas for Improvement
<p><b>8. Chhatimane water Scheme</b></p> <p>Barbhanjyang VDC</p> <p>Gravity - Rehabilitation scheme</p> <p>Total 178 HHs with 890 population</p>	<ul style="list-style-type: none"> <li>• The scheme is about to completed Within a month.</li> <li>• Construction quality/workmanship of RVT and intake are observed good.</li> <li>• WUSC have purchased the at source to use the water.</li> <li>• WUSG is registered; and WUSC is active (Total 9 members).</li> <li>• Public hearing and mid-term public audit has been completed.</li> <li>• The WUSC is involved in procurement and quality checking of non-local materials.</li> <li>• WUSC has maintained all relevant documents, books of accounts etc.</li> </ul>	<ul style="list-style-type: none"> <li>• WUSC/MW needs on-site hands-on support as refresher training on post construction and O&amp;M management to make them capable in regular repair and maintenance work.</li> <li>• WUSC has not yet decided any modality for future O&amp;M system; water tariff collection not started; and no mobilization and payment started to MW. So they need to be oriented and supported to decide future O&amp;M system and practice on it.</li> <li>• WUSC/MW has to be made aware on water safety plan (WSP) and water quality testing</li> </ul>

	<ul style="list-style-type: none"> <li>• GI pipe has been used in stream crossing.</li> <li>• There is one intake and three RVTs built.</li> <li>• Boulder packing have been provided from source to intake/CC in order save from contamination.</li> </ul>	<ul style="list-style-type: none"> <li>• Following minor technical problems need to be corrected:             <ul style="list-style-type: none"> <li>- Distribution pipe lines need to be buried properly at adequate depth (90cm).</li> <li>- The HDP pipe (around 8 mtr) has been observed exposed below the intake structure. As the site is rocky area the pipe could not be buried properly. Hence, there is possibility of vandalism and forest-fire which may damage the pipe. So it should be changed by GI pipe.</li> <li>- Some of the gate-valves at distribution pipe line and near Distribution Chamber need to be changed</li> <li>- Fencing needed at intake and one RVT.</li> </ul> </li> <li>• WUSC should be oriented on the removal of shrub/weeds around the intake and RVT areas regularly.</li> </ul>
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**Photo 1: View of Intake/catchment; fencing needed pipe to be replaced**

**Exposed HDP Pipe at rocky area below Intake**



**Photo 3: Source land bought by WUSC**



**Photo 4: RVT with proper fencing.**



**Photo 5 and 6: Open pipelines at different stretches in distribution system need to be buried at proper depth**

## Monitoring Checklist for Completed DWS Schemes (for post construction visits)

District: <u>Syanga</u> , VDC: <u>Kyakmi</u>		Ward No: <u>1,2 and 9</u> WUSC name: <u>Dagdibazzar water scheme</u>	
Visit Date: <u>19 / 07 / 2012</u>		Scheme Type: <u>Gravity</u> Construction start date: <u>067/02/10</u> Completion date: <u>068/07/20</u>	
Total households <u>62</u> ; Total present population served <u>410</u> ; Total costs NRs. <u>2315974</u> Major structures built: <u>Intake, RVT</u>			
1 WUSC registration certificate	<input checked="" type="checkbox"/>	Approved and available	Approved but not with WUSC <input type="checkbox"/> Submitted for approval <input type="checkbox"/> Process not started <input type="checkbox"/>
2 WUSC constitution	<input checked="" type="checkbox"/>	Available with WUSC	Not with WUSC <input type="checkbox"/> Not yet drafted <input type="checkbox"/>
3 Design documents	<input checked="" type="checkbox"/>	Available with WUSC	Not with WUSC <input type="checkbox"/> Completeness of DE documents: <input type="checkbox"/>
4 Implementation agreement	<input checked="" type="checkbox"/>	Available with WUSC	Not with WUSC <input type="checkbox"/>
5 Minimum 1% O&M saving made	<input checked="" type="checkbox"/>	No <input type="checkbox"/> Yes <input type="checkbox"/> If no remarks:..... If yes, amount collected:..... (% collected)	
7 O & M bank a/c	<input checked="" type="checkbox"/>	Opened <input type="checkbox"/> Regularly used <input type="checkbox"/> Total Savings (till date) Rs: <u>125000</u>	
8 Under whose name is the bank a/c opened		WUSC name <input checked="" type="checkbox"/> Chair Name <input checked="" type="checkbox"/> Treasurer name <input checked="" type="checkbox"/> Secretary name <input type="checkbox"/>	
9 Saved money invested or used	<input checked="" type="checkbox"/>	Given to as loan and with interest rate <input type="checkbox"/> Other investment (7% interest) <input type="checkbox"/> Used for maintenance <input type="checkbox"/> Not used <input type="checkbox"/>	
10 Copies of bills/receipts maintained by WUSC	<input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/> Submitted to DDC from time to time <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	
11 Accounting book with WUSC	<input checked="" type="checkbox"/>	Available <input type="checkbox"/> Well kept and updated <input type="checkbox"/> Poorly kept <input type="checkbox"/> Maintained by <input type="checkbox"/> Treasurer <input type="checkbox"/> Others <input type="checkbox"/>	
12 Books of minutes of meetings/records	<input type="checkbox"/>	Available <input checked="" type="checkbox"/> Well kept and updated <input type="checkbox"/> Poorly kept <input type="checkbox"/>	
13 WUSC holding meeting regularly	<input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/> No. of formal meetings held till date <input type="checkbox"/>	
14 Book of labor contribution recording	<input checked="" type="checkbox"/>	Available <input type="checkbox"/> Well kept and updated <input type="checkbox"/> Poorly kept <input type="checkbox"/> Not maintained <input type="checkbox"/>	
16 Display board maintained	<input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Contains all relevant information <input type="checkbox"/> Not informative <input type="checkbox"/>	
20 Public hearing (after agreement)	<input checked="" type="checkbox"/>	Done <input type="checkbox"/> Not done <input type="checkbox"/> No of times held <input type="checkbox"/> No. of HHs participated <input type="checkbox"/>	
21 Final Public audit (after scheme completion)	<input checked="" type="checkbox"/>	Done <input type="checkbox"/> Not done <input type="checkbox"/> Remarks:.....	
23 Tools available	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/> If yes, main tools:.....	
24 MW/pump operator selected	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes <input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Training received Yes <input type="checkbox"/> No <input type="checkbox"/> Caste/ethnicity:.....	
25 MW payment started	<input type="checkbox"/>	No payment <input type="checkbox"/> Paid in cash Amount Rs/month <input type="checkbox"/> paid in kind <input type="checkbox"/>	
26 Water Tariff collection started	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes If yes, Rs <u>2400</u> /hh/m; Total collection per month Rs <input type="checkbox"/> (Till 15 units = Rs.50 and every units more Rs.5)	
29 Quality of construction work	<input checked="" type="checkbox"/>	Good <input type="checkbox"/> Satisfactory <input type="checkbox"/> Poor <input type="checkbox"/> Remarks:.....	
30 Functionality of the system	<input checked="" type="checkbox"/>	Good <input type="checkbox"/> Satisfactory <input type="checkbox"/> Poor <input type="checkbox"/> Remarks:.....	
31 Water quality tested	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes; Tested quality found <input type="checkbox"/> Good <input checked="" type="checkbox"/> Satisfactory <input type="checkbox"/> Poor <input type="checkbox"/>	
32 Water safety plan implemented	<input checked="" type="checkbox"/>	No <input type="checkbox"/> Yes <input type="checkbox"/>	
33 Training received by WUSC	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes If yes, Post-construction <input checked="" type="checkbox"/> Procurement & Quality check <input type="checkbox"/> Book keeping <input checked="" type="checkbox"/>	

They have all contribution from DDC and VDC.

Monitoring Checklist for Completed DWS Schemes (for post construction visits)											
District: <u>Syanja</u>		VDC: <u>Kewarehanjyang</u>		Ward No: _____		WUSC name: <u>Bankatta water scheme.</u>					
Visit Date: <u>21</u> / <u>07</u> / <u>2012</u>		Scheme Type: <u>Lifting</u>		Construction start date: <u>066/11/12</u>		Completion date: <u>067/11/12</u>					
Total households <u>46</u> ; Total present population served <u>825</u> ; Total costs NRs. <u>40,81,960</u> Major structures built: <u>RVT, Intake</u>											
1	WUSC registration certificate	<input checked="" type="checkbox"/>	Approved and available	<input type="checkbox"/>	Approved but not with WUSC	<input type="checkbox"/>	Submitted for approval	<input type="checkbox"/>	Process not started		
2	WUSC constitution	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	<input type="checkbox"/>	Not yet drafted				
3	Design documents	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	Completeness of DE documents:					
4	Implementation agreement	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC						
5	Minimum 1% O&M saving made	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If no remarks:.....					
6	Implementation bank a/c (operation a/c)	<input type="checkbox"/>	Closed	<input type="checkbox"/>	Not yet closed	If not closed, Bank balance Rs:.....					
7	O & M bank a/c	<input checked="" type="checkbox"/>	Opened	<input type="checkbox"/>	Regularly used	Total Savings (till date) Rs: _____					
8	Under whose name is the bank a/c opened	<input type="checkbox"/>	WUSC name	<input checked="" type="checkbox"/>	Chair Name	<input checked="" type="checkbox"/>	Treasurer name	<input checked="" type="checkbox"/>	Secretary name		
9	Saved money invested or used	<input checked="" type="checkbox"/>	Given to as loan and with interest rate _____	<input type="checkbox"/>	Other investment _____	<input type="checkbox"/>	Used for maintenance	<input checked="" type="checkbox"/>	Not used		
10	Copies of bills/receips maintained by WUSC	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No	Submitted to DDC from time to time		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
11	Accounting book with WUSC	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	Maintained by <input type="checkbox"/> Treasurer <input type="checkbox"/> Others			
12	Books of minutes of meetings/records	<input type="checkbox"/>	Available	<input checked="" type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept				
13	WUSC holding meeting regularly	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No	No. of formal meetings held till date					
14	Book of labor contribution recording	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	<input type="checkbox"/>	Not maintained		
15	Book of storekeeping (stock book)	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	<input type="checkbox"/>	Not maintained		
16	Display board maintained	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Contains all relevant information	<input type="checkbox"/>	Not informative		
20	Public hearing (after agreement)	<input checked="" type="checkbox"/>	Done	<input type="checkbox"/>	Not done	<input type="checkbox"/>	No of times held	No. of HHs participated .....			
21	Final Public audit (after scheme completion)	<input type="checkbox"/>	Done	<input checked="" type="checkbox"/>	Not done	Remarks:.....					
23	Tools available	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If yes, main tools: _____					
24	MW/pump operator selected	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	Male	<input type="checkbox"/>	Female	Training received Yes <input type="checkbox"/> No <input type="checkbox"/>	Caste/ethnicity:.....
25	MW payment started	<input type="checkbox"/>	No payment	<input checked="" type="checkbox"/>	Paid in cash Amount Rs/month <u>4000</u>	paid in kind _____					
26	Water Tariff collection started	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If yes, Rs <u>500</u> /hh/m; Total collection per month Rs <u>14000</u>					
28	All proposed structures built	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If, no remarks:.....					
29	Quality of construction work	<input checked="" type="checkbox"/>	Good	<input type="checkbox"/>	Satisfactory	<input type="checkbox"/>	Poor	Remarks:.....			
30	Functionality of the system	<input checked="" type="checkbox"/>	Good	<input type="checkbox"/>	Satisfactory	<input type="checkbox"/>	Poor	Remarks:.....			
31	Water quality tested	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes; Tested quality found	<input type="checkbox"/>	Good	<input checked="" type="checkbox"/>	Satisfactory	<input type="checkbox"/>	Poor
33	Training received by WUSC	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	If yes, Post-construction		<input type="checkbox"/>	Procurement & Quality check	<input checked="" type="checkbox"/>	Book keeping <input checked="" type="checkbox"/>
34	Water fetching time saved	<input type="checkbox"/>	in minutes	<input type="checkbox"/>	Water Quality/WSP	<input type="checkbox"/>	O&M/MW Refresher	<input checked="" type="checkbox"/>	Others (specify).....		
36	Is there any HH left being member of WU?	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>	Yes	No. of HHs not covered by DWS		Reason for not being members:			
37	Is there any cross subsidies for poor HHs?	<input type="checkbox"/>	yes	<input checked="" type="checkbox"/>	No						

Monitoring Checklist for the Under Construction DWS Schemes (under Implementation Phase)									
District: <u>Myagdi</u> , VDC: <u>Arman</u>		WUSC name: <u>Handebhir krosebagar</u>							
Visit Date: <u>12</u> / <u>07</u> / <u>2012</u>		Scheme Type: <u>Gravity</u>		Construction start date <u>2069/01/27</u> ..... Estimated completion date...about to complete.....					
Total households <u>23</u> ; Total present population to be served <u>150</u> ; Total costs NRs. <u>RS. 521817,85</u>				Major structures proposed...Intake,RVT,Distribuiton chamber					
1	WUSC registration certificate	<input checked="" type="checkbox"/>	Approved and available	<input type="checkbox"/>	Approved but not with WUSC	<input type="checkbox"/>	Submitted for approval	<input type="checkbox"/>	Process not started
2	WUSC constitution	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	<input type="checkbox"/>	Not yet drafted		
3	Design Estimate (DE) documents	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	WUSC/users aware of Scheme Cost		<input type="checkbox"/>	yes <input type="checkbox"/> No
4	Completeness of DE document	<input checked="" type="checkbox"/>	Complete	<input type="checkbox"/>	Partial	If partial, Remarks.....			
5	Implementation phase agreement	<input type="checkbox"/>	Available with WUSC	<input checked="" type="checkbox"/>	Not with WUSC	Remarks.....			
6	Minimum 1% upfront O&M fund collected	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If no, remarks (why).....					
7	O&M Bank account opened	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If yes, Total O&M saving Rs <u>5698.08</u>		% collected .....			
8	1% upfront capital cost collected	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes						
9	Funds received by WUSC from DDF (Till Date)	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If yes, Rs... <u>3,87506.84</u>		Contribution from DDC		<input checked="" type="checkbox"/>	yes <input type="checkbox"/> No If yes, Rs... <u>17095.87</u>
10	Operating bank Account opened	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If yes, Bank balance Rs... <u>5698.08</u>					
15	Copies of bills/receipts maintained by WUSC	<input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No	If No, remarks (why).....					
16	Accounting books by WUSC	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	Maintained by	<input type="checkbox"/> Treasurer <input type="checkbox"/> Others
17	Books of minutes of meetings/records	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/> Poorly kept			
18	WUSC holding meeting regularly	<input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No	No. of formal meetings held till date.....					
20	Book of labor contribution recording	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	<input type="checkbox"/> Not maintained	
22	Display board maintained	<input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/>	Contains all relevant information	<input type="checkbox"/> Not informative			
27	DWS Community Action Plan prepared by WUSC	<input type="checkbox"/>	No <input type="checkbox"/> Yes	If yes, are the WUSC/users aware of it and following <input type="checkbox"/> yes <input type="checkbox"/> No					
28	Public hearing done (before agreement in appraisal)	<input checked="" type="checkbox"/>	Done <input type="checkbox"/> Not done	<input type="checkbox"/>	No of times held	Remarks.....			
29	Public audit (mid - term) after procurement & storage	<input checked="" type="checkbox"/>	Done <input type="checkbox"/> Not done	<input type="checkbox"/>	No of times held	Remarks.....			
30	Maintenance Worker (MW)/ Pump Operator selected	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If yes, <input type="checkbox"/> Male <input type="checkbox"/> Female		Trained: <input type="checkbox"/> yes <input type="checkbox"/> No		Caste/ethnicity.....	
31	Construction Status (structures built)	<input checked="" type="checkbox"/>	on-going <input type="checkbox"/> Stopped	Structures built till date:.....					
32	Quality of construction work	<input type="checkbox"/>	Good <input checked="" type="checkbox"/> Satisfactory	<input type="checkbox"/>	Poor	Remarks.....			
33	Water quality tested (of source)	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	Tested quality found		<input checked="" type="checkbox"/>	Good <input type="checkbox"/> Satisfactory <input type="checkbox"/> Poor		
34	Water safety plan prepared/implemented	<input checked="" type="checkbox"/>	No <input type="checkbox"/> Yes	Remarks.....					
35	Training received by WUSC and others	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If yes, Pre-construction		<input checked="" type="checkbox"/>	Procurement & Quality check	<input type="checkbox"/>	Book keeping <input checked="" type="checkbox"/>
				Water Quality/WSP		<input type="checkbox"/>	MW <input checked="" type="checkbox"/> Pump Operator	<input type="checkbox"/>	Others (specify).....



District: <u>Rupandehi</u> , VDC: <u>Parroha</u>		Ward No: <u>5</u>		WUSC name: <u>Hariyali water scheme</u>	
Visit Date: <u>21 / 07 / 2012</u>		Scheme Type: <u>Lifting</u>			
Total households <u>102</u> ; Total present population to be served <u>510</u> ; Total costs NRs. <u>about 3000000</u>				Major structures proposed:..... <u>RVT and Tubewell</u>	
1	WUSC registration certificate	<input checked="" type="checkbox"/> Approved and available	<input type="checkbox"/> Approved but not with WUSC	<input type="checkbox"/> Submitted for approval	<input type="checkbox"/> Process not started
2	WUSC constitution	<input checked="" type="checkbox"/> Available with WUSC	<input type="checkbox"/> Not with WUSC	<input type="checkbox"/> Not yet drafted	
3	Design Estimate (DE) documents	<input checked="" type="checkbox"/> Available with WUSC	<input type="checkbox"/> Not with WUSC	WUSC/users aware of Scheme Cost	<input type="checkbox"/> yes <input type="checkbox"/> No
4	Completeness of DE document	<input checked="" type="checkbox"/> Complete	<input type="checkbox"/> Partial	If partial, Remarks.....	
5	Implementation phase agreement	<input checked="" type="checkbox"/> Available with WUSC	<input type="checkbox"/> Not with WUSC	Remarks.....	
6	Minimum 1 % upfront O&M fund collected	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If no, remarks (why).....		If yes, amount (Rs).....
7	O&M Bank account opened	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If yes, Total O&M saving Rs <u>28000</u>		% collected .....
9	Funds received by WUSC from DDF (Till Date)	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If yes, Rs.....		Contribution from DDC <input checked="" type="checkbox"/> yes <input type="checkbox"/> No If yes, Rs.....
10	Operating bank Account opened	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes			
11	Under whose name is the bank A/Cs opened	WUSC name <input checked="" type="checkbox"/>	Chair Name <input checked="" type="checkbox"/>	Treasurer name <input checked="" type="checkbox"/>	Secretary name <input checked="" type="checkbox"/>
13	Who supported WUSC in procurement	WASH Unit Technical Staff <input type="checkbox"/>	DTO staff <input checked="" type="checkbox"/>	SP's Technical Staff <input type="checkbox"/>	None (by WUSC themselves) <input type="checkbox"/>
14	Who involved in ensuring material quality	WASH Unit Technical Staff <input type="checkbox"/>	DTO staff <input checked="" type="checkbox"/>	SP's Technical Staff <input type="checkbox"/>	None (by WUSC themselves) <input type="checkbox"/>
15	Copies of bills/receipts maintained by WUSC	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	If No, remarks (why).....		
16	Accounting books by WUSC	<input checked="" type="checkbox"/> Available	<input type="checkbox"/> Well kept and updated	<input type="checkbox"/> Poorly kept	Maintained by <input type="checkbox"/> Treasurer <input type="checkbox"/> Others
17	Books of minutes of meetings/records	<input checked="" type="checkbox"/> Available	<input type="checkbox"/> Well kept and updated	<input type="checkbox"/> Poorly kept	
18	WUSC holding meeting regularly	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No		
20	Book of labor contribution recording	<input checked="" type="checkbox"/> Available	<input type="checkbox"/> Well kept and updated	<input type="checkbox"/> Poorly kept	<input type="checkbox"/> Not maintained
22	Display board maintained	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Contains all relevant information		<input type="checkbox"/> Not informative
27	DWS Community Action Plan prepared by WUSC	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	If yes, are the WUSC/users aware of it and following <input type="checkbox"/> yes <input type="checkbox"/> No		
28	Public hearing done (before agreement in appraisal)	<input checked="" type="checkbox"/> Done <input type="checkbox"/> Not done	No of times held		Remarks.....
29	Public audit (mid - term) after procurement & storage	<input checked="" type="checkbox"/> Done <input type="checkbox"/> Not done	No of times held		Remarks.....
30	Maintenance Worker (MW)/ Pump Operator selected	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If yes, <input checked="" type="checkbox"/> Male <input type="checkbox"/> Female	Trained: <input type="checkbox"/> yes <input type="checkbox"/> No	Caste/ethnicity.....
31	Construction Status (structures built)	<input type="checkbox"/> on-going <input type="checkbox"/> Stopped	Structures built till date:.....		
32	Quality of construction work	<input type="checkbox"/> Good <input checked="" type="checkbox"/> Satisfactory	<input type="checkbox"/> Poor		Remarks.....
33	Water quality tested (of source)	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	Tested quality found <input type="checkbox"/> Good <input checked="" type="checkbox"/> Satisfactory <input type="checkbox"/> Poor		
34	Water safety plan prepared/implemented	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	Remarks.....		
35	Training received by WUSC and others	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If yes, Pre-construction <input checked="" type="checkbox"/>	Procurement & Quality check <input type="checkbox"/>	Book keeping <input checked="" type="checkbox"/>
			Water Quality/WSP <input type="checkbox"/>	MW <input type="checkbox"/>	Pump Operator <input type="checkbox"/>
					Others (specify).....
36	Is there any HH left being user/beneficiary?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	No. of HHs not covered by DWS		Reason for not being members:
37	Is there any cross subsidies for poor HHs?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> No			
water tariff collection has been started. Pumping rate = 0.0045 m <sup>3</sup> /sec					
They just have got first installment and last installment is remaining to get					

District: <u>Baglung,</u> VDC: <u>Bihunkot</u>		Ward No: <u>6-7</u> WUSC name: <u>Jukepani water scheme.</u>	
Visit Date: <u>13 / 07 / 2012</u>		Scheme Type: <u>Gravity</u> Construction start date... <u>2067/12/18</u> ..... Estimated completion date... <u>2068/12</u> .....	
Total households <u>77</u> ; Total present population to be served <u>441</u>		Total costs NRs. <u>19,15,127</u> Major structures proposed:.....	
1	WUSC registration certificate	<input checked="" type="checkbox"/> Approved and available	<input type="checkbox"/> Approved but not with WUSC <input type="checkbox"/> Submitted for approval <input type="checkbox"/> Process not started
2	WUSC constitution	<input checked="" type="checkbox"/> Available with WUSC	<input type="checkbox"/> Not with WUSC <input type="checkbox"/> Not yet drafted
3	Design Estimate (DE) documents	<input checked="" type="checkbox"/> Available with WUSC	<input type="checkbox"/> Not with WUSC WUSC/users aware of Scheme Cost <input type="checkbox"/> yes <input type="checkbox"/> No
4	Completeness of DE document	<input checked="" type="checkbox"/> Complete	<input type="checkbox"/> Partial If partial, Remarks.....
5	Implementation phase agreement	<input checked="" type="checkbox"/> Available with WUSC	<input type="checkbox"/> Not with WUSC Remarks.....
6	Minimum 1% upfront O&M fund collected	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If no, remarks (why)..... If yes, amount (Rs).....
7	O&M Bank account opened	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If yes, Total O&M saving Rs <u>20000</u> % collected .....
8	1% upfront capital cost collected	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If no, remarks (why)..... If yes, amount (Rs).....
9	Funds received by WUSC from DDF (Till Date)	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If yes, Rs.....15000..... Contribution from DDC <input type="checkbox"/> yes <input checked="" type="checkbox"/> No If yes, Rs..... Contribution from VDC <input checked="" type="checkbox"/> yes <input type="checkbox"/> No If yes, Rs.....15000.....
10	Operating bank Account opened	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If yes, Bank balance Rs.....
11	Under whose name is the bank A/Cs opened	<input type="checkbox"/> WUSC name <input checked="" type="checkbox"/> Chair Name <input type="checkbox"/> Treasurer name <input checked="" type="checkbox"/> Secretary name	
12	Who did procurement of non-local materials	<input checked="" type="checkbox"/> WUSC members	<input type="checkbox"/> Procurement committee <input type="checkbox"/> Others than WUSC/Community
13	Who supported WUSC in procurement	<input type="checkbox"/> WASH Unit Technical Staff	<input checked="" type="checkbox"/> DTO staff <input type="checkbox"/> SP's Technical Staff <input type="checkbox"/> None (by WUSC themselves)
14	Who involved in ensuring material quality	<input type="checkbox"/> WASH Unit Technical Staff	<input checked="" type="checkbox"/> DTO staff <input type="checkbox"/> SP's Technical Staff <input type="checkbox"/> None (by WUSC themselves)
15	Copies of bills/receipts maintained by WUSC	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	If No, remarks (why).....
16	Accounting books by WUSC	<input checked="" type="checkbox"/> Available	<input type="checkbox"/> Well kept and updated <input type="checkbox"/> Poorly kept Maintained by <input type="checkbox"/> Treasurer <input type="checkbox"/> Others
17	Books of minutes of meetings/records	<input checked="" type="checkbox"/> Available	<input type="checkbox"/> Well kept and updated <input type="checkbox"/> Poorly kept
18	WUSC holding meeting regularly	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	No. of formal meetings held till date.....
20	Book of labor contribution recording	<input checked="" type="checkbox"/> Available	<input type="checkbox"/> Well kept and updated <input type="checkbox"/> Poorly kept <input type="checkbox"/> Not maintained
22	Display board maintained	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Contains all relevant information <input type="checkbox"/> Not informative
23	Total members in WUSC (nos)	<input checked="" type="checkbox"/> Total	<input type="checkbox"/> Male <input type="checkbox"/> Female
27	DWS Community Action Plan prepared by WUSC	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	If yes, are the WUSC/users aware of it and following <input type="checkbox"/> yes <input type="checkbox"/> No
28	Public hearing done (before agreement in appraisal)	<input checked="" type="checkbox"/> Done <input type="checkbox"/> Not done	No of times held Remarks.....
29	Public audit (mid - term) after procurement & storage	<input checked="" type="checkbox"/> Done <input type="checkbox"/> Not done	No of times held Remarks.....
30	Maintenance Worker (MW)/ Pump Operator selected	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If yes,	<input type="checkbox"/> Male <input type="checkbox"/> Female Trained: <input type="checkbox"/> yes <input type="checkbox"/> No Caste/ethnicity.....
31	Construction Status (structures built)	<input type="checkbox"/> on-going <input type="checkbox"/> Stopped	Structures built till date:.....
32	Quality of construction work	<input checked="" type="checkbox"/> Good <input type="checkbox"/> Satisfactory <input type="checkbox"/> Poor	Remarks.....
33	Water quality tested (of source)	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes; Tested quality found	<input type="checkbox"/> Good <input type="checkbox"/> Satisfactory <input type="checkbox"/> Poor
35	Training received by WUSC and others	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	If yes, Pre-construction <input checked="" type="checkbox"/> Procurement & Quality check <input checked="" type="checkbox"/> Book keeping <input checked="" type="checkbox"/> Water Quality/WSP <input type="checkbox"/> MW <input checked="" type="checkbox"/> Pump Operator <input type="checkbox"/> Others (specify).....

Monitoring Checklist for Completed DWS Schemes (for post construction visits)											
District: <u>Myagdi</u>		VDC: <u>dudhekhola</u>			WUSC name: <u>Odare Jukepani</u>						
Visit Date: <u>12/07/2012</u>		Construction start date... <u>2066/03/26</u> ..... Completion date..... <u>2067/03/20</u> .....									
Total households <u>18</u> ; Total present population served _____ ; Total costs NRs. <u>695742.24</u>		Major structures built:.....Intake and RVT.....									
1	WUSC registration certificate	<input checked="" type="checkbox"/>	Approved and available	<input type="checkbox"/>	Approved but not with WUSC	<input type="checkbox"/>	Submitted for approval	<input type="checkbox"/>	Process not started		
2	WUSC constitution	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	<input type="checkbox"/>	Not yet drafted				
3	Design documents	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	Completeness of DE documents:					
4	Implementation agreement	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC						
5	Minimum 1 % O&M saving made	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If no remarks.....					
6	Implementation bank a/c (operation a/c)	<input type="checkbox"/>	Closed	<input checked="" type="checkbox"/>	Not yet closed	If not closed, Bank balance Rs.....11000 in loan with 2 % interest.....					
7	O & M bank a/c	<input checked="" type="checkbox"/>	Opened	<input type="checkbox"/>	Regularly used						
8	Under whose name is the bank a/c opened	<input type="checkbox"/>	WUSC name	<input checked="" type="checkbox"/>	Chair Name	<input checked="" type="checkbox"/>	Treasurer name	<input checked="" type="checkbox"/>	Secretary name		
9	Saved money invested or used	<input checked="" type="checkbox"/>	Given to as loan and with interest rate <u>2%</u>	<input type="checkbox"/>	Other investment	<input type="checkbox"/>	Used for maintenance	<input type="checkbox"/>	Not used		
10	Copies of bills/receipts maintained by WUSC	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No	Submitted to DDC from time to time		<input type="checkbox"/>	Yes <input type="checkbox"/>	No	
11	Accounting book with WUSC	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	Maintained by <input type="checkbox"/>		Treasurer <input type="checkbox"/>	Others
12	Books of minutes of meetings/records	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept				
13	WUSC holding meeting regularly	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	No. of formal meetings held till date				
14	Book of labor contribution recording	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	<input type="checkbox"/>	Not maintained		
16	Display board maintained	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	Contains all relevant information		<input type="checkbox"/>	Not informative	
20	Public hearing (after agreement)	<input type="checkbox"/>	Done	<input checked="" type="checkbox"/>	Not done	<input type="checkbox"/>	No of times held		No. of HHs participated .....		
21	Final Public audit (after scheme completion)	<input type="checkbox"/>	Done	<input checked="" type="checkbox"/>	Not done	Remarks:.....					
23	Tools available	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes						
24	MW/pump operator selected	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	Male	<input type="checkbox"/>	Female	Training received Yes <input checked="" type="checkbox"/>	
25	MW payment started	<input type="checkbox"/>	No payment	<input type="checkbox"/>	Paid in cash Amount Rs/month _____, paid in kind _____						
26	Water Tariff collection started	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If yes, Rs <u>20</u> /hh/m; Total collection per month Rs <u>500</u>					
29	Quality of construction work	<input checked="" type="checkbox"/>	Good	<input type="checkbox"/>	Satisfactory	<input type="checkbox"/>	Poor	Remarks.....			
30	Functionality of the system	<input type="checkbox"/>	Good	<input type="checkbox"/>	Satisfactory	<input type="checkbox"/>	Poor	Remarks.....			
31	Water quality tested	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes; Tested quality found						
33	Training received by WUSC	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If yes, <input type="checkbox"/>	labour work	<input type="checkbox"/>	O&M/MW Refresher	<input type="checkbox"/>	Others (Book keeping <input checked="" type="checkbox"/>

Monitoring Checklist for the Under Construction DWS Schemes (under Implementation Phase)									
District: <u>Baglung</u> , VDC: <u>Bihunkot</u>		Ward No: <u>6 and 7</u> WUSC name: <u>Saharsadhara water scheme</u>							
Visit Date: <u>  /  /  </u>		Scheme Type: <u>Gravity</u>		Construction start date: <u>068/01/08</u>			Estimated completion date: <u>068/11/10</u>		
Total households <u>11</u> ; Total present population to be served <u>110</u> ; Total costs NRs. <u>30,77,162</u>									
1	WUSC registration certificate	<input checked="" type="checkbox"/>	Approved and available	<input type="checkbox"/>	Approved but not with WUSC	<input type="checkbox"/>	Submitted for approval	<input type="checkbox"/>	Process not started
2	WUSC constitution	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	<input type="checkbox"/>	Not yet drafted		
3	Design Estimate (DE) documents	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	WUSC/users aware of Scheme Cost		<input type="checkbox"/>	yes <input type="checkbox"/> No
4	Completeness of DE document	<input checked="" type="checkbox"/>	Complete	<input type="checkbox"/>	Partial	If partial, Remarks.....			
5	Implementation phase agreement	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	Remarks.....			
6	Minimum 1% upfront O&M fund collected	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If no, remarks (why).....			If yes, amount (Rs).....		
7	O&M Bank account opened	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If yes, Total O&M saving Rs <u>&gt;75000</u>		% collected .....			
9	Funds received by WUSC from DDF (Till Date)	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If yes, Rs... <u>84000</u>		Contribution from DDC		<input checked="" type="checkbox"/>	yes <input type="checkbox"/> No
				Contribution from VDC		<input checked="" type="checkbox"/>	yes <input type="checkbox"/> No	If yes, Rs... <u>22000</u>	
10	Operating bank Account opened	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes						
11	Under whose name is the bank A/Cs opened	<input type="checkbox"/>	WUSC name	<input checked="" type="checkbox"/>	Chair Name	<input checked="" type="checkbox"/>	Treasurer name	<input checked="" type="checkbox"/>	Secretary name
13	Who supported WUSC in procurement	<input type="checkbox"/>	WASH Unit Technical Staff	<input checked="" type="checkbox"/>	DTO staff	<input type="checkbox"/>	SP's Technical Staff	<input type="checkbox"/>	None (by WUSC themselves)
15	Copies of bills/receipts maintained by WUSC	<input type="checkbox"/>	Yes <input type="checkbox"/> No	If No, remarks (why).....					
16	Accounting books by WUSC	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	Maintained by <input type="checkbox"/> Treasurer <input type="checkbox"/> Others	
17	Books of minutes of meetings/records	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept		
18	WUSC holding meeting regularly	<input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No	No. of formal meetings held till date.....					
20	Book of labor contribution recording	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	<input type="checkbox"/>	Not maintained
22	Display board maintained	<input checked="" type="checkbox"/>	Yes <input type="checkbox"/> No	<input type="checkbox"/> Contains all relevant information		<input checked="" type="checkbox"/> Not informative			
23	Total members in WUSC (nos)	<input checked="" type="checkbox"/>	Total	<input type="checkbox"/>	Male	<input type="checkbox"/>	Female		
27	DWS Community Action Plan prepared by WUSC	<input checked="" type="checkbox"/>	No <input type="checkbox"/> Yes	If yes, are the WUSC/users aware of it and following <input type="checkbox"/> yes <input type="checkbox"/> No					
28	Public hearing done (before agreement in appraisal)	<input checked="" type="checkbox"/>	Done <input type="checkbox"/> Not done	<input type="checkbox"/>	No of times held	Remarks.....			
29	Public audit (mid - term) after procurement & storage	<input checked="" type="checkbox"/>	Done <input type="checkbox"/> Not done	<input type="checkbox"/>	No of times held	Remarks.....			
30	Maintenance Worker (MW)/ Pump Operator selected	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If yes, Male <input type="checkbox"/> Female		Trained: <input type="checkbox"/> yes <input type="checkbox"/> No		Caste/ethnicity.....	
31	Construction Status (structures built)	<input type="checkbox"/>	on-going <input type="checkbox"/> Stopped	Structures built till date:.....					
32	Quality of construction work	<input checked="" type="checkbox"/>	Good <input type="checkbox"/> Satisfactory	<input type="checkbox"/>	Poor	Remarks.....			
33	Water quality tested (of source)	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	Tested quality found		<input checked="" type="checkbox"/>	Good <input type="checkbox"/> Satisfactory	<input type="checkbox"/>	Poor
34	Water safety plan prepared/implemented	<input checked="" type="checkbox"/>	No <input type="checkbox"/> Yes	Remarks.....					
35	Training received by WUSC and others	<input type="checkbox"/>	No <input checked="" type="checkbox"/> Yes	If yes, Pre-construction		<input checked="" type="checkbox"/>	Procurement & Quality check	<input checked="" type="checkbox"/>	Book keeping <input checked="" type="checkbox"/>
				Water Quality/WSP		<input checked="" type="checkbox"/>	MW <input type="checkbox"/> Pump Operator	<input type="checkbox"/>	Others (specify).....

District: <u>Rupandehi</u> , VDC: <u>Devdaha</u>		Ward No: <u>3 and 5</u>		WUSC name: <u>Tallo sarantandi scheme</u>						
Visit Date: <u>21/07/2012</u>		Scheme Type: <u>Gravity</u>								
Total households <u>22</u> ; Total present population to be served <u>197</u> ;										
No. of HHs by Caste/ethnic groups:		Dalits..... Aadibasi/Janjati..... Dis. Adv. Terai Caste..... Religious Minority..... Brahmin/Chhetri..... Others.....								
1	WUSC registration certificate	<input checked="" type="checkbox"/>	Approved and available	<input type="checkbox"/>	Approved but not with WUSC	<input type="checkbox"/>	Submitted for approval	<input type="checkbox"/>	Process not started	
2	WUSC constitution	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	<input type="checkbox"/>	Not yet drafted			
3	Design Estimate (DE) documents	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	WUSC/users aware of Scheme Cost		<input type="checkbox"/>	yes <input type="checkbox"/> No	
4	Completeness of DE document	<input checked="" type="checkbox"/>	Complete	<input type="checkbox"/>	Partial	If partial, Remarks.....				
5	Implementation phase agreement	<input checked="" type="checkbox"/>	Available with WUSC	<input type="checkbox"/>	Not with WUSC	Remarks.....				
6	Minimum 1% upfront O&M fund collected	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes					
7	O&M Bank account opened	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes					
9	Funds received by WUSC from DDF (Till Date)	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	If yes, Rs.....	Contribution from DDC	<input type="checkbox"/>	yes <input type="checkbox"/> No If yes, Rs.....	
10	Operating bank Account opened	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If yes, Bank balance Rs.....3,385.....				
11	Under whose name is the bank A/Cs opened	<input type="checkbox"/>	WUSC name	<input checked="" type="checkbox"/>	Chair Name	<input checked="" type="checkbox"/>	Treasurer name	<input checked="" type="checkbox"/>	Secretary name	
13	Who supported WUSC in procurement	<input type="checkbox"/>	WASH Unit Technical Staff	<input checked="" type="checkbox"/>	DTO staff	<input type="checkbox"/>	SP's Technical Staff	<input type="checkbox"/>	None (by WUSC themselves)	
15	Copies of bills/receipts maintained by WUSC	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No	If No, remarks (why).....				
16	Accounting books by WUSC	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	Maintained by	<input type="checkbox"/>	Treasurer <input type="checkbox"/> Others
17	Books of minutes of meetings/records	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept			
18	WUSC holding meeting regularly	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No	No. of formal meetings held till date.....				
20	Book of labor contribution recording	<input checked="" type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	<input type="checkbox"/>	Not maintained	
21	Book of storekeeping (stock book)	<input type="checkbox"/>	Available	<input type="checkbox"/>	Well kept and updated	<input type="checkbox"/>	Poorly kept	<input checked="" type="checkbox"/>	Not maintained	
22	Display board maintained	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	Contains all relevant information	<input type="checkbox"/>	Not informative	
24	Women in key positions	<input type="checkbox"/>	Chair	<input type="checkbox"/>	Secretary	<input checked="" type="checkbox"/>	Treasurer	<input type="checkbox"/> Nos. as members		
27	DWS Community Action Plan prepared by WUSC	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>	Yes	If yes, are the WUSC/users aware of it and following		<input type="checkbox"/>	yes <input type="checkbox"/> No	
28	Public hearing done (before agreement in appraisal)	<input checked="" type="checkbox"/>	Done	<input type="checkbox"/>	Not done	<input type="checkbox"/>	No of times held	Remarks.....		
29	Public audit (mid - term) after procurement & storage	<input checked="" type="checkbox"/>	Done	<input type="checkbox"/>	Not done	<input type="checkbox"/>	No of times held	Remarks.....		
30	Maintenance Worker (MW)/ Pump Operator selected	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If yes, <input checked="" type="checkbox"/>	Male <input type="checkbox"/>	Female	Trained: <input type="checkbox"/>	yes <input type="checkbox"/> No Caste/ethnicity.....
32	Quality of construction work	<input checked="" type="checkbox"/>	Good	<input type="checkbox"/>	Satisfactory	<input type="checkbox"/>	Poor	Remarks.....		
33	Water quality tested (of source)	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes; Tested quality found	<input type="checkbox"/>	Good <input checked="" type="checkbox"/>	Satisfactory	<input type="checkbox"/>	Poor
34	Water safety plan prepared/implemented	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>	Yes	Remarks.....				
35	Training received by WUSC and others	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>	Yes	If yes, Pre-construction	<input checked="" type="checkbox"/>	Procurement & Quality check	<input type="checkbox"/>	Book keeping <input type="checkbox"/>
						Water Quality/WSP	<input type="checkbox"/>	MW <input checked="" type="checkbox"/>	Pump Operator	Others (specify).....
36	Is there any HH left being user/beneficiary?	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>	Yes	No. of HHs not covered by DWS		Reason for not being members:		
37	Is there any cross subsidies for poor HHs?	<input type="checkbox"/>	yes	<input checked="" type="checkbox"/>	No					