



Rural Water Supply and  
Sanitation Project in  
Western Nepal Phase II

2015

# Water Safety Planning Guideline for Overhead Schemes

With integrated Operation & Maintenance Plan and  
Water Tariff Calculation



Project Support Unit  
FCG International Ltd  
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## Acronyms

DDC	District Development Committee
DMC	District Management Committee
DoLIDAR	Department for Local Infrastructure Development and Agricultural Roads
D-WASH-CC	District WASH Coordination Committee
LCDP	Liters per capita per day
NPR	Nepalese Rupee
O&M	Operation & Maintenance
RWSSP-WN	Rural Water Supply and Sanitation Project in Western Nepal
VDC	Village Development Committee
VMW	Village Maintenance Worker
V-WASH-CC	VDC WASH Coordination Committee
WASH	Water, Sanitation and Hygiene
WSP	Water Safety Plan
WUSC	Water Users and Sanitation Committee

## Reference materials

1. Handbook on Community-wide Water Safety Planning, MoFALD/DoLIDAR, 2013.
2. Water Safety Plan Handbook 2070, Department of Water Supply and Sewerage
3. Recharge Pond Handbook for WASH Program, MoFALD/DoLIDAR, 2013.
4. Step-by-Step Manual for Sustainable Water Supply Services, 2013, RWSSPWN-II
5. WASH Climate Resilient Development. Local participatory water supply and climate change risk assessment: Modified water safety plans. Global Water Partnership and UNICEF 2014.

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*This guideline has been prepared to instruct Water Supply and Sanitation User's Committee (WUSC) and water safety planning facilitators in the preparation and implementation of Water Safety Plan (WSP) and providing training on the same.*

*WSP++ concept combines Water Safety Plans which pays attention also to Climate Change Adaptation & Disaster Risk Reduction, and Operation & Maintenance together with water tariff*

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## STEP-BY-STEP TO WATER SAFETY PLAN (WSP)



## 1. Background

This guideline has been prepared to instruct Water Users and Sanitation Committee (WUSC) and water safety planning facilitators in the preparation and implementation of **Water Safety Plan (WSP)** and providing training on the same. The primary responsibility of each WUSC is to provide safe supply as well as safe quality drinking water to the people of its scheme area. Safe water supply refers to quantity of water and functionality of the scheme, where as safe quality drinking water is free of bacterial contamination and concentration of chemical contamination as per the National Drinking Water Quality Standards of Nepal.

WSP ensures the safe supply and quality of drinking water through the use of a comprehensive risk assessment and risk management approach that covers all steps in water supply scheme from catchment to consumer. WSP addresses the following:

- Possible areas of water contamination, its causes and how to prevent contamination;
- Direct and indirect environmental and climate-induced hazards to continuous water supply and how to mitigate or adapt to them;
- Monitoring the implementation of the WSP, i.e. implementation of control measures and hazard mitigation and adaptation measures;
- Ensuring the continuous distribution of safe drinking water.

WSP training will be provided to the WUSC members and WSP Team to improve their capacity in preparation and implementation of WSP. This guideline has been prepared with the objective that each WUSC will be capable to *implement* their WSP in their scheme.

## 2. Introduction to Water Safety Plan

Safe supply and quality of drinking water can be assured through a variety of interventions at different levels, from households to entire communities often with an excellent cost–benefit ratio. The main reasons why each drinking water supply scheme should have their own WSP are listed below:

- WSP secures public health by ensuring safe quality drinking water in water supply systems;
- WSP helps to secure continuity of water supply by mitigating and adapting to direct and indirect environmental and climate-induced hazards that may threaten safe water supply. Measures can be taken to prevent direct hazards such as landslides, floods/excess runoff and depletion of water sources. Catchment degradation, such as degraded vegetation and exposed soil, is an indirect hazard that can be the main cause of other direct hazards;
- Prevention of water contamination and hazards to the scheme is less costly and more effective than acting after the damage has already taken place. Thus it is essential to identify the possible areas of water contamination and assess direct and indirect hazards that can affect the scheme in each and every component of the WS scheme, from catchment to the mouth, and plan for preventive actions;

- Operation and Maintenance (O&M) plan is integrated along with the WSP;
- It is of utmost importance to collect adequate water tariff to cover regular operation and maintenance and repair works. WUSCs can also plan for upgrading or improving the scheme and catchment with collected O&M funds. Tariff calculation methods are introduced at the end of this guideline.

## 2.1. Objective of Water Safety Plan Implementation

- To increase the awareness of consumers regarding the provision of safe supply and safe quality of drinking water;
- To help the consumers/water users to maintain and upgrade their scheme for the provision of safe supply and safe quality of drinking water;
- To prevent the water sources from contamination, and to prevent contamination of water during collection in the reservoir tank, distribution, storage, and use;
- To take necessary measures to mitigate or adapt to direct and indirect environmental and climate-induced hazards that can disrupt safe water supply in different ways: Landslides mainly cause damage to the scheme structures; floods or excess runoff can cause damage to structures and also contaminate water; source depletion and dry-up affect the availability of water. Measures can be planned and implemented to prevent such hazards, reduce their impact and to adapt to live with the changes.

## 2.2. Basis for Successful Water Safety Plan

WSP indicates the various activities that need to be performed to maintain safe supply and safe quality drinking water, from boring to mouth. User's participation and commitment is essential to keep the water safe. Therefore, for the successful implementation of WSP, following criteria should be fulfilled:

- WUSC registered in District Water Resources Committee;
- WUSC conducting meetings regularly;
- Public auditing & hearing and mass meetings conducted on regular basis;
- Establishment of Operation and Maintenance (O&M) fund and development of operation and maintenance regulation;
- WUSC carrying out minor repair and maintenance work on regular basis;
- Trained maintenance worker(s) who carry out their work regularly;
- Regular collection of sufficient water tariff;
- Committed WUSC with 50% representation of women and proportional representation of Disadvantaged Groups;
- Active Village Water Supply, Sanitation and Hygiene Coordination Committee (V-WASH-CC), their cooperation and participation in preparation and implementation of WSP;
- After completion of the scheme, all the tools and remaining fittings/pipes and other materials are collected, recorded, properly stored and managed by an assigned person. Tools and left-over materials and components should be used for the maintenance and repair of the scheme.

### 3. Steps of Water Safety Plan

There are six steps in the cycle of WSP which are explained below. First, the WSP Team is formed from among the users of the scheme. After that, the water supply system and the status of the scheme is analyzed. The third step is to identify different hazards that can cause water contamination or otherwise disrupt the safe supply of water. Measures to address these hazards are discussed and included in WSP under the step four. The short-term WSP consists of regular (day to day) activities and minor improvement activities that can be implemented with WUSC's own resources. Long-term measures that are likely to require outside support can be implemented gradually. Implementation of the WSP should be monitored regularly (step 5). The final step is to review, report and document the effectiveness of the WSP implementation and plan for any corrective measures to improve the WSP.

#### 3.1. Formation of WSP Team

As the first step, a team dedicated to preparation, monitoring and verification of WSP will be formed by the scheme users. Members of the WSP Team should also take responsibility for implementation of the activities identified in the WSP, although also other users (those who are not members of the WSP Team) or groups can be named responsible for implementing different activities. The WSP Team must coordinate with other stakeholders to obtain the necessary resources in order to support the WUSC in implementing the WSP and other activities related to it.

**The WSP Team should be formed as follows:**

- Call for a mass meeting of all the users;
- Discuss the above mentioned basis of success of WSP in a mass meeting and fill the findings in the format 2. At this point, the users' commitment to implement all the criteria points should be ensured; Format 2 also includes information that is needed for the calculation of adequate water tariff rate.
- Select the members of the WSP Team in the mass meeting. The WSP Team should consist of users of the scheme only. The WSP Team should include WUSC members, other representatives of the users and the VMW. Other optional members (if available among the users) include representative of V-WASH-CC, women health worker or volunteer, teachers and VDC's technical person.
- WUSC Chairperson shall be the Team Coordinator. It is mandatory for the WSP Team to include the WUSC Chairperson and VMW.
- The composition of the WSP Team should be recorded in the format 1.
- The WSP Team shall decide which water quality parameters should be tested before starting the WSP preparation.



**Tasks of WSP Team are as follows:**

- Conduct the **steps 1, 2, 3 and 4** for the WSP preparation:
  - Analysis of the water supply system and its surrounding environment. Fill the formats 3-4.
  - Visit the scheme from the area of boring to community/private tap to identify and analyze the probable causes and areas of water contamination and direct and indirect environmental and climate-induced hazards. Fill up the formats 6a;
  - Prepare the short and long term plans using the same formats 6a and 6b. The plans should include measures to prevent water contamination and to mitigate or adapt to the identified environmental and climate-induced hazards;
- Conduct the **steps 5 and 6** concerning monitoring, verification, review and documentation of WSP. In case the control measures or mitigation and adaptation measures do not work, other improvement measures must be formulated and implemented in coordination with WUSC;
- Verify the control measures undertaken under the WSP to safeguard the water from contamination by testing water quality (**step 5**). Prepare a written record of all activities, including monitoring and verification;
- Follow up on the environmental and climate-induced hazard mitigation and adaptation measures to assess whether they are effectively implemented and are leading towards the expected impacts (**step 5**);
- Users' satisfaction survey is to be conducted every 6 months to assess the effectiveness of WSP implementation from the perspective of public health and continuity of water supply, as well as to address the complaints of users regarding the water facilities (**step 6**).
- The findings of the WSP monitoring, users' satisfaction survey and water quality tests, as well as any corrective/improvement measures to the WSP will be discussed in a mass meeting.

### 3.2. Analysis of the water supply system

The WSP Team should get an understanding of the water supply system as a whole and its components and their locations. The purpose and operation processes of different components must be clear to all WSP Team members:

- The WSP Team should list all structures of the scheme in the format 3.
- The WSP Team should draw a community/layout map (format 4) of the water supply system, showing all components (boring, overhead tanks, pump station, distribution chambers, wash-out and air valves, distribution lines and tap stands), community features (houses/clusters, buildings, roads) and environmental features (forests, cultivations, grazing grounds, rivers etc.);
- The WSP Team should define the influencing zone of boring. Different land use patterns around the boring that may cause infiltration of polluted water into the boring, as well as areas of landslides and floods should be observed and discussed. These should be recorded in the community map (format 4);

- The WSP Team shall describe the boring characteristics in terms of discharge, seasonality/reliability, and record the findings (format 3);

### 3.3. Identifying and assessing hazards, risks and existing control methods

After the system analysis, the next step is to analyze different hazards that can disrupt safe supply and safe quality of water. The WSP Team should visit the water supply scheme from the boring area to the tap and identify A) risks to safe water quality, and B) direct and indirect environmental and climate induced hazards that can affect safe water supply (i.e. quantity of water and functionality of the scheme). WSP Team should write down the findings of the assessment in format 6a.

#### A) Identifying risks to safe water quality

- Every structure of the scheme should be inspected to track down the possible areas and ways of water contamination. Water turbidity at the source should be observed. Water storage and its use should also be monitored at household level. The findings of the inspection should be filled in the “Hazard and risk assessment, plan preparation, implementation and monitoring form (format 6a)”.
- The bacterial contamination of the water should be tested by a bacterial test kit (H2S bottle), or on the basis of “Presence or Absence of Vial”. The results of the tests should be recorded in the “Water Quality Test Result form (format 5)”.
- Arsenic is one of the key water quality parameters of ground water in Terai, thus it is of utmost importance to test the arsenic concentration by Arsenator.

#### B) Identifying direct and indirect hazards that can affect safe water supply

- Before starting the inspection of the water supply scheme (step 3.3 A), the WSP Team should discuss the current rainfall pattern, including amount of precipitation and its seasonal distribution, as well as the variability of discharge in the source (assessed under step 2). This should be based on community knowledge, including people’s experience in extreme weather events or changes in the climate pattern. The WSP Team should also discuss what the implications for safe water supply (i.e. quantity of water) are.
- The WSP Team must assess the environmental and climate-induced hazards, particularly the magnitude and frequency of flooding, and their possible impacts on water resources, quality of water and scheme structures. These hazards and their possible implications should be observed during the inspection of the boring, its influencing zone and other water supply structures.
- The identified hazards should be filled out in the “Hazard and risk assessment, plan preparation, implementation and monitoring form” (format 6a).

### 3.4. Preparation and implementation of WSP and monitoring plan

After identifying the hazards and risks to ensuring safe supply and safe quality drinking water, the control and mitigation measures to prevent the hazard and minimize the risks, as well as measures to adapt to the changes (e.g. more intense droughts and floods), should be discussed. Examples of measures to address different hazards and risks are presented in chapter 4. Short-term and long-term activities should be identified and the need of internal or external support should be assessed.

- Short-term plan (format 6a) will consist of regular (day to day) activities and minor improvement measures that can be implemented with WUSC's own resources (without external support). The short-term plan should focus on prevention of water contamination through various control measures. Similarly, simple activities for reducing disaster risks (e.g. drainage channels for flood water, preparedness for floods) should be included in the short-term plan.
- Long term plan (format 6b) should include major mitigation and adaptation activities to natural hazards, as well as major repair and upgrading works of water supply system. Implementation of the long term activities may require outside support (whether technical or financial) or long-term saving by the users; such requirements should be already mentioned in the plan.
- Both short- and long-term plan should be prepared based on discussion on the above matters. Questions on who and by when are answered to with regard to implementation and monitoring of the Plan, with clear roles and responsibilities. Specific responsible person(s) should be assigned rather than assigning a group or team of people for each of the planned activities.
- WSP prepared by the WSP Team shall be approved in a mass meeting in which the users and committee members shall commit for its implementation.
- Short-term measures of WSP should be implemented immediately and/or on regular basis (e.g. regular maintenance).
- Long-term measures can be implemented gradually.

### 3.5. Monitoring and verification of WSP

The objective of WSP is to ensure provision of safe water supply and safe quality water by identified control, mitigation and adaptation measures. For this, WSP Team should prepare a **monitoring plan** on the same format (format 6a and 6b) and commit to monitoring the implementation of WSP (i.e. all the measures identified in WSP).

- Since the monitoring is a continuous process, it should be carried out both before and after implementing specific measures so that the impact/effect of WSP is assessed.
- Water quality testing mechanism should be established and testing carried out in regular basis. Since testing of water quality for all parameters indicated by National Drinking Water Quality Standard 2065 is often challenging, priority should be given to testing of Arsenic contamination in case of Tarai ground water schemes, and testing of bacterial contamination by "*Presence/Absence Vial*".

- In addition to arsenic and bacterial contamination, it is also recommended to test regularly the chemical parameters of drinking water, such as concentration of Turbidity, pH value, iron and ammonia. Nitrate and phosphate should be tested especially when the source is located in/downstream of agricultural field.
- All water quality tests should be recorded (example in [format 5](#)).
- Water discharging capacity of boring should be followed up to identify the trend of ground water surcharge in the boring.
- A user survey must be conducted at least every 6 months to find out the satisfaction level of the users and the effectiveness of the WSP. The template is given in [Annex 1](#).

### 3.6. Review, reporting and documenting

The effectiveness of WSP should be reviewed within the team, based on monitoring findings, water quality testing and user survey findings. The findings and way forward are discussed in a mass meeting, with an objective to ensure the effective implementation of WSP in future.

- Carry out a review of the monitoring findings as well as water quality test and user survey findings carried out under **step 5**.
- Discuss the results and way forward in a mass meeting. WSP can be improved based on any emerging issues.
- All forms must be filled in every 6 months or as decided by the mass meeting. Since these forms also indicate the status after the maintenance work, it helps to monitor the level of improvement in continuity of water supply and quality of water after the implementation of WSP has started.
- Information and required assistance regarding the implementation of WSP should be provided to the related VDC, V-WASH-CC, D-WASH-CC, (Sub) Divisional Office of the Department of Water Supply and Sewerage and DDC (information center).
- Documentation and review of the implementation of WSP must be done by WSP Team on regular basis.

## 4. Examples of measures to take under WSP

### 4.1. Control measures to prevent water contamination and to ensure quality of water

Below are listed some examples of control measures to ensure safe water quality. The measures should be discussed among the WSP Team members and selected so that they address the risks identified in **the step 3**.

- Ensure that the influencing zone of the boring is free of open defecation, solid waste and other possible contaminants. Prohibit leaving dead carcasses and other decaying or contaminating items in the influencing zone.
- Construction or repair of fencing around the water supply structures to avoid haphazard entrance of human beings and animals to the structures.

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- Construct and maintain run off drainages around the boring, overhead tank and other structures to prevent water contamination and safeguard the structures from possible damage.
- If the boring is located in an industrial area, contamination of chemical substances is possible. Hence, control measures for pollution from industries must be managed.
- Repair breakages in pipelines to prevent water/soil and possible contaminants entering the pipe from outside when the pipe is empty, and to prevent water leakage when there is water in the pipe.
- Bury all plastic (HDPE) pipes to a sufficient depth below the ground level.
- Cover slabs of tanks and chambers should be regularly monitored and immediately repaired if they are found broken or leaking.
- Inside and outside of all the structures, including the boring, should be regularly cleaned up.
- Rusted or non-functional pipes and fittings should be replaced.
- Prohibit the practices of taking water from public taps to individual households using open pipes as there are more chances to contaminate the water through these open pipes.
- Protect the pipelines and other structures, fittings etc. from entering the sewerage or other possible source of contamination.
- Regularly clean the tap stands/platforms.
- Chlorination can be considered if there is presence of bacterial contamination. Household level water treatment/purification methods are described below.

### Household water treatment techniques

Although the improved structures of water supply scheme protect water from pollution, it may still be necessary to treat the water at household level to ensure the quality of drinking water. Especially during rainy season and any diarrhea epidemics, the WSP Team should advocate all the households within their scheme area to adopt water treatment techniques and advice all consumers to use water only after its treatment if there is any doubt of water contamination.

**Water can be purified by the following techniques:**

- **Sedimentation:** Storing of water in a closed vessel for a day destroys approximately 50 % of harmful germs. After sedimentation of the muddy particles that normally make water blurry, the water appears clear.
- **Filtration:** Water can be filtered using a piece of clean cloth or a ceramic filter. This method only filters the germs but does not kill them. Most filters are not fully effective because microscopic bacteria can pass through the filter. However, some filter types such as silver coated candle filter and bio-sand filter work on the microscopic bacteria as well.

**Following techniques are used for destroying the germs and bacteria:**

- **Boiling:** Most of the germs in water can be destroyed after boiling the water once. In places of higher altitude, water should be boiled for additional three minutes. Boiling is the best method for ensuring quality of drinking water.
- **Chlorination:** Water can be treated by using water treatment chemicals, such as Piyush and water guard, which can be bought in the market. It is importance to follow the instructions written in the packet while using these chemicals; wrong dosing of the chemical can cause serious health implications. Water should be stirred properly after mixing the chlorine. After the treatment, water will be safe to drink only after half an hour.
- **SODIS technique:** This method should be used only if other methods are not available, because it rarely kills all the bacteria. Storing of clean water in a transparent plastic bottle with a closed cap in the sun for 6-7 hours destroys some of the bacteria. In a cloudy day, the exposure period should be pre-lengthened up to two days.

## Other Supporting Programs

For ensuring safe water quality in the scheme, open defecating habit should be totally banned. It should be ensured that every household has constructed and is using a toilet within the scheme and the water catchment area.

To prevent contamination of water, hand washing with soap is particularly critical in the following four situations:

- After using toilet and cleaning child's feces.
- After touching dirt.
- Before eating or feeding a baby.
- Before cooking or serving food.

## 4.2. Mitigation and adaptation measures to environmental and climate-induced hazards

In the Terai context, **flooding** is the most serious climate-induced hazard that can disrupt the provision of safe supply and safe quality of water. Flooding can impact water safety in two ways: by causing water contamination (e.g. when polluted surface water enters into borings, tanks and pipelines) and by causing damage to scheme structures. Various adaptation options to reduce the impact of floods on water structures and water quality are discussed in the below sub-chapter.

Other than floods, **strong winds and storms** can sweep away components in the over-head tank systems if they are not properly fixed. High over-head tanks can also add to the devastation impact of **earthquake** if they are not constructed according to the standards, or if the buildings are not maintained well.

## Measures to adapt to flooding

- Improving resilience of the boring by, for example, casing the boring with water tight material and raising the wellhead above the ground and surrounding it by a concrete apron with a drainage channel.
- Flood protection of the boring e.g. by levees, drainage ditches, artificial waterways and soil and water conservation and re-vegetation on the boring influencing zone to enhance infiltration and reduce runoff.
- Household water treatment, safe storage of water and improved hygienic behavior.
- Improved sanitation, i.e. ending open defecation and establishing proper waste management to prevent pollution of water sources during floods.
- Adjustments to the location and design of latrines to prevent water pollution during floods; ensuring minimum distance between latrines and water sources, raising latrines to keep minimum distance between pit and water table, regular emptying of pits, composting latrines etc.
- Emergency preparedness (e.g. water treatment kits, spare pipes and fittings) and disaster information notice.

## 5. Water Tariff and Cost Recovery

The concept of water tariff has been introduced to raise sufficient funds for regular operation and maintenance activities, repair of damaged structures and replacement of components, for implementation of improvement or upgrading works, and pay for the VMW or other labor work etc. The O&M fund is vital for smooth operation of water supply schemes. In addition, the community should also prepare for the 'cost recovery' of the scheme. Since the scheme needs to be rehabilitated or reconstructed at the end of its life cycle, a specific fund should be generated through water tariff collection throughout its life cycle. The purpose of 'cost recovery' of a water supply scheme is to prepare the community to fully rehabilitate or replace the scheme once it comes to the end of its life cycle.

### **Two main objectives of Introducing Water Tariff are to:**

- Collect fund for daily operating costs and repair and maintenance investment;
- Collect sufficient fund for replacement of the scheme after the design period is over.

### **Data required to calculate the water tariff:**

- Total project cost;
- Design period of the scheme;
- Estimated annual cost for maintenance and repair works;
- Annual salary and allowances of WUSC staff and maintenance workers;
- Annual WUSC and office management expenses;
- Population & population growth rate (in percentage);
- Household population & household population growth rate;

- Water demand in Per capita per day;
- Annual inflation rate

### Method of calculating water tariff

**Uniform Rate Method:** In this method, uniform rate is charged, irrelevant to amount of water used by the users. This is calculated for household cost for water use per month. This method is applicable to small scheme.

Monthly household water tariff rate =	$\frac{\text{Annual cost recovery} + \text{annual operation cost}}{12 \times \text{no. of households}}$
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**Consumption Rate Method:** In this method the water tariff is charged according to the volume of water consumed.

Per liter rate =	$\frac{\text{Annual cost recovery} + \text{annual operation cost}}{\text{Annual water consumption in liters}}$
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The Uniform rate and Consumption rate methods are described in detail in [Annex 2](#).



## 6. Water Safety Plan and Operation & Maintenance related formats

### Format 1: Details of WSP Team

Details of WSP Team					
Scheme:		Date:			
VDC:		Village Name:			
Ward No.					
S.N	Mr/Ms Name	Cluster Name	M/F	Designation	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					

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**Format 2: Water Supply Scheme Operation, Maintenance and Management**

Water Supply Scheme Operation, Maintenance and Management	
Scheme Name:	Date:
Total project cost:	Scheme design period:

S.N	Status of WS scheme Operation and Management	Yes/No/data	If No		
			How to Manage	By whom?	When?
1	Users Committee Registration				
2	WUSC has a bank account				
3	Regular meeting of the WUSC				
4	Financial and stock management				
5	Proper management and storage of tools and components				
6	Public Auditing				
7	Annual general assembly				
8	Mobilization of VMW				
9	Implementation of O&M directive of WUSC				
10	Regular minor maintenance and repair work				
11	Operation and maintenance fund				

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S.N	Status of WS scheme Operation and Management	Yes/No/data	If No		
			How to Manage	By whom?	When?
12	Regular collection of water tariff				
13	Estimated annual cost for maintenance and repair works				
14	Annual salary and allowances of VMW and other possible staff/workers				
15	Annual WUSC and office management expenses				
16	Population & population growth rate (%)				
17	Number of households and growth rate of new HHs (%)				
18	Water demand per capita per day				
19	Annual inflation rate				

Note: Questions 13-19 are used in calculation of the water tariff rate.

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**Format 3: Scheme details**

Scheme Details	
Scheme Name:	No. of household:
VDC:	Population:
Construction Start Date:	Ward No.:
Construction Completed Date:	VMW Name:
Support Agencies:	WUSC's account No:
Support organization:	Bank or Finance company:
WUSC's Registration No:	WUSC's registration date:

S.N	Details	#/unit	Remark
1	Boring		
2	Discharge of boring (liters per second)		
3	Pump, capacity		
4	Transformer/solar panel capacity		
5	Length of electricity line		
6	Electrical poles		
7	MCB/Panel board (switch board)		

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S.N	Details	#/unit	Remark
8	Lightening Arrestor/Earthing		
9	Overhead Tank & capacity		
10	Outlet of overhead tank		
11	Distribution Chamber		
12	Valve Chamber		
13	Wash Out		
14	Total distribution pipe line length		
15	Public Taps		
16	Private Taps		
17	School Number		
18	Private Toilet		
19	Institutional Toilet		

**Format 4: Community map with layout**

<b>Community Map with Layout</b>	
Scheme Name:	VDC:
Village Name	Ward No:
Date:	

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Format 5: Water quality test results

Water Quality Test Result												
Source Name and Type:												
Test Method & Equipment:												
Test by:												
S.N.	Parameters	Nepal Standard	Unit	Water quality test place, date and result								
					Source (Intake)-1	Source (Intake)-2	Structure (CC / IC)	Reservoir Tank 1	Reservoir Tank 2	Tap 1	Tap 2	House hold level
1	Arsenic	0.05	Mg/l	Date								
				Unit								
				Date								
				Unit								
2	Bacterial Contamination	nill	*CFU/ 100 ml or /+u	Date								
				Unit								
				Date								
				Unit								
3	pH	6.5 to 8.5		Date								
				Unit								
				Date								
				Unit								
4	Ammonia	1.5	mg/L	Date								

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				Unit								
				Date								
				Unit								
5	Iron	0.3 (3)	Mg/l	Date								
				Unit								
				Date								
				Unit								

\*Unit may differ depending on testing method.

Note: The quality of water to be tested before and after of WSP implementation and each year after rainy season at least for the bacterial contamination.



Rural Water Supply and Sanitation Project in Western Nepal Phase II  
**Overhead Scheme Water Safety, Operation and Maintenance Plan Preparation Guideline: WSP+++**

Format 6a: Short-term plan (regular maintenance and minor repair, control and mitigation works)

<h2 style="margin: 0;">Water Safety Plan</h2> <p style="margin: 0;"><b>Hazard and risk assessment, Short-term plan preparation, implementation and monitoring</b></p> <p style="margin: 0;">Regular maintenance and minor repair, control, adaptation and mitigation works (preventive works)</p>									
Scheme Name:			Village:			Total Taps:			
VDC:			Ward No.:			Name of VMW:			
Structure and Place	Risk	Cause of Risk (Present Condition)	Y/ N	Immediate or regular works?	Implementation		Monitoring		
					When?	By whom?	When?	By whom?	Activities Implementation Status (Done /Not done)
1. Boring	Contamination of ground water	No fencing or damaged fencing							
		Access of people or animal to the boring							
		Unsafe use of toilet within the influencing zone of the boring							
		Damage of intake cover							
		Infiltration of contaminated surface water to ground water							
		Water logging							
		Infiltration of chemical matters from surrounding areas							

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Structure and Place	Risk	Cause of Risk (Present Condition)	Y/ N	Immediate or regular works?	Implementation		Monitoring		
					When?	By whom?	When?	By whom?	Activities Implementation Status (Done /Not done)
		Damaged boring platform							
2.Electro- mechanical elements (Pump, Transformer/solar panel, MCB/Panel board, Lightening Arrestor/ Earthing, electricity line, poles, Water level electrode)	Obstruction in safe water supply	Damage or rusting due to lack of regular inspection, repair or replacement							

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Structure and Place	Risk	Cause of Risk (Present Condition)	Y/ N	Immediate or regular works?	Implementation		Monitoring		
					When?	By whom?	When?	By whom?	Activities Implementation Status (Done /Not done)
3. Overhead reservoir tank and other structures	Contamination through structures (valve chamber, distribution chamber)	No fencing around structures, human settlement near by the structures							
		Completely damaged or cracks on covers of structures							
		Cracks and leakage from the structure							
		Valve chamber damaged							
		Pollution around structures							
		Pollution inside the structures							
		Water logging around the structures							
		Water logging in the chamber having fittings							
		Leakage from the fittings used in the structure							
		Flooding around structures during monsoon							

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Structure and Place	Risk	Cause of Risk (Present Condition)	Y/ N	Immediate or regular works?	Implementation		Monitoring		
					When?	By whom?	When?	By whom?	Activities Implementation Status (Done /Not done)
4. Distribution line	Contamination of water through pipe lines, washing away of pipe line by flood, land slide	Pipeline in landslide prone zone							
		Exposed pipeline in the ground							
		Pipeline damaged by nails/pegs							
		Leakage from pipeline							
		Pipeline joint connected by plastic or clothes							
		Damage of pipe support block							
		Rusting of fittings							
		Pipeline in sewerage drain							
		Pipeline in water logged areas							
		Damaged pipe support blocks							

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Structure and Place	Risk	Cause of Risk (Present Condition)	Y/ N	Immediate or regular works?	Implementation		Monitoring		
					When?	By whom?	When?	By whom?	Activities Implementation Status (Done /Not done)
5. Taps (Public/Private)	Contamination from taps	Cracked or broken tap stands							
		Dirty tap platforms							
		Leakage from the tap structure							
		Pollution around tap structure							
		Unmanaged drainage of waste water from the taps							
		Multiple private pipes connected to the taps							
		Washing of dishes in public taps							
		Water drained in the roads							
6. Use of water at household level		Water pots not properly cleaned before use							
		Water pots are not covered							

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Structure and Place	Risk	Cause of Risk (Present Condition)	Y/ N	Immediate or regular works?	Implementation		Monitoring		
					When?	By whom?	When?	By whom?	Activities Implementation Status (Done /Not done)
		No filtering or boiling of water							
		Dirty utensils are used to drink water							
		Pollution/poor waste management around houses							
		Unsafe toilets in the houses							
		No habit of hand washing with soap after using toilets							
Names of the people monitoring the existing condition									

Rural Water Supply and Sanitation Project in Western Nepal Phase II  
**Overhead Scheme Water Safety, Operation and Maintenance Plan Preparation Guideline: WSP+++**

Format 6b: Long-term plan (Major repair, upgrading and risk reduction activities)

<h2 style="margin: 0;">Water Safety Plan</h2> <h3 style="margin: 0;">Water Supply Scheme long term planning, Implementation and Monitoring</h3>								
Major repair, upgrading and risk reduction activities								
Scheme Name:			Village:			Total Taps:		
VDC:			Ward:			Name of VMW:		
Location and Structure	Present Status	Long-term activities	Source of fund (Internal or external)	Implementation		Monitoring		
				By when?	By whom?	By when?	By whom?	Implementation Status (Done/ Not done)
1. Boring								
2. Pump/pumping main pipe								

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Location and Structure	Present Status	Long-term activities	Source of fund (Internal or external)	Implementation		Monitoring		
				By when?	By whom?	By when?	By whom?	Implementation Status (Done/ Not done)
3. Electrical Accessories (Transformer /solar panel, MCB/Panel board, Lightening Arrestor/ Earthing, electricity line, poles, Water level electrode)								
4. Overhead tank and other chambers								



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Location and Structure	Present Status	Long-term activities	Source of fund (Internal or external)	Implementation		Monitoring		
				By when?	By whom?	By when?	By whom?	Implementation Status (Done/ Not done)
5. Pipelines								
6. Taps (public/private)								
Names of the people monitoring the existing condition								

**Rural Water Supply and Sanitation Project in Western Nepal Phase II**  
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**Annex 1: Users' satisfaction survey for water and sanitation scheme**

**Consumer Satisfaction Survey Form**

**Name of the head member of the household:**

**Date:**

1	Is there regular daily water supply in your tap (around the day)?	Regular	Satisfactory	Irregular	Never		
2	Is the quantity of water available to you adequate for household use?	Yes	No				
3	How many months in a year water is available (through this scheme)?	12 months	9-11 months	6-8 months	Less than 6 months		
4	How much time do you need for a round trip of water fetching?	< 15 min	15 to 30 min	30 to 45 min	> 45		
5	Do you think water is safe from its source to the tap?	Totally safe	Satisfactory	Unsafe	Too much unsafe		
6	Are you satisfied with the rate of water tariff?	Yes	No, it's too high	No, it's too low			
7	How the repair and maintenance is carried out in your water supply scheme?	Regular	Sometime	According to the necessity	Never		
8	Does WUSC provide enough information to the users on O&M fund (balance, tariffs collected, how it is used)	Yes	No				
9	Does the WUSC listen and take action to your complaints?	Yes	No				
10	Who mostly takes care of the water supply system?	WUSC	VMW	Consumer	Nobody		
11	How satisfied are you with the activities and services of the WUSC?	Very good	Good	Satisfactory	Bad		
12	How often is your community tap monitored by the VMW or WUSC?	Regular	Satisfactory	Irregular	Never		
13	What do you think about the cleanliness of taps/platforms in the communities?	Very clean	Clean	Satisfactory	Dirty		
14	Is there always clean water in your tap?	Always	Most of the time	Sometime	Never		
15	What do you think in general the quality of the water which you are using?	Very good	Good	Satisfactory	Bad		
16	What main improvement measures do you think that the WUSC should make in this water supply scheme?						
17	What kind of purification technique do you use for purifying the drinking water in your home?						
	Nothing	Boiling	Chlorination	Filter	SODIS technique	Sedimentation	Others (mention it)
18	Data collected within the last six months related to the water borne diseases (selected households)						
	Cholera	Typhoid	Diarrhea	Dysentery	Intestinal worms	Jaundice	Others
	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No

## Annex 2: Method for Calculating Water Tariff for Cost Recover

Cost Details	First Year	Second Year	Third Year
<b>A. Scheme Recovery Cost</b>	Scheme total cost ÷ Scheme Project Life (years) = NPR	Previous Years Recovery Cost X ( 1 + Inflation rate in percentage)	Previous Years Recovery Cost X ( 1 + Inflation rate in percentage)
Total of A	Total of A	Total of A	Total of A
<b>B. Annual operation cost</b>			
1. Annual repair & maintenance cost	2% to 3% of total cost of Scheme	Previous Years Maintenance Cost X ( 1 + Inflation rate in percentage)	Previous Years Maintenance Cost X ( 1 + Inflation rate in percentage)
2. Annual salary and allowance expenses	Annual salary and allowance expenses for the First year	Previous Years Annual salary and allowance expenses X ( 1 + Inflation rate in percentage)	Previous Years Annual salary and allowance expenses X ( 1 + Inflation rate in percentage)
3. Annual office and management cost of WSUC	Annual operation and management cost of WSUC for the First Year	Previous Years Annual operation and management cost of WSUC X ( 1 + Inflation rate in percentage)	Previous Years Annual operation and management cost of WSUC X ( 1 + Inflation rate in percentage)
Total of B	Total of B	Total of B	Total of B
Total A+ B	Total A+ B	Total A+ B	Total A+ B
C. Contingency ( 5% to 10% of A+B)	Contingency ( 5% to 10% of A+B)	Contingency ( 5% to 10% of A+B)	Contingency ( 5% to 10% of A+B)
<b>D. Total Cost (A+B+C)</b>	<b>D. Total Cost (A+B+C)</b>	<b>D. Total Cost (A+B+C)</b>	<b>D. Total Cost (A+B+C)</b>

When determining the number of households for next year, the increased number of households according to the current annual household growth rate should be added to the household number of the current year.

After determining the total annual cost, water tariff is calculated as follows:

**A. Uniform Rate Method:** In this method, uniform rate is charged, irrelevant to amount of water used by the users. This is calculated for household cost for water use per month. This method is applicable to a small scheme.

Monthly household water tariff rate =	$\frac{\text{Annual cost recovery + annual operation cost}}{12 \times \text{no. of households}}$
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**B. Consumption Rate Method:** In this method the water tariff is set according to the quantity of water consumed.

Per liter rate =	$\frac{\text{Annual cost recovery + annual operation cost}}{\text{Annual water consumption in liters}}$
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Method for calculating annual water demand (annual water consumption):

$$(\text{total beneficiary population}) \times (\text{liters per capita per day}) \times 365$$

While determining the population for next year, the increased nos. population according to the current annual population growth rate should be added to the population of current year.

**Example:**

Data for calculating water tariff (*This data should be collected during the Step 1 of the WSP preparation, and recorded in the format 2*):

Total Scheme Cost	NPR 3,303,412
Project life	20 years
Estimated annual operation and maintenance cost	
2.5% of total project cost = 3,303,412 X 0.025 =	NPR 82,585
Annual salary and allowance expenses	NPR 140,000
Annual operation and management cost of WSUC	NPR 14,400
Population	4,833
Number of households	886
Annual household growth rate	2%
Annual population growth rate	2.4%
Water demand (liters per capita per day)	45 liters/capita/day
Annual Inflation Rate	7%

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Cost Details	First Year	Second Year	Third Year	Using the same method, calculate for the other years
A. Scheme Recovery Cost	$3,303,412 \div 20 = 165,170$	$165,170 \times 1.07 = 176,732$	$176,732 \times 1.07 = 189,103$	
Total of A	165,170	176,732	189,103	
B. Annual Operation Cost				
1. Annual Maintenance cost	82,585	$82,585 \times 1.07 = 88,336$	$88,336 \times 1.07 = 94,552$	
2. Annual salary and allowance expenses	140,000	$140,000 \times 1.07 = 149,800$	$149,800 \times 1.07 = 160,286$	
3. Annual operation and management cost of WSUC	14,400	$14,400 \times 1.07 = 15,408$	$15,408 \times 1.07 = 16,487$	
Total of B	236,985	253,574	271,325	
Total A+ B	402,155	430,306	460,428	
C. Contingency ( 5% to 10% of A+B)	$402,155 \times 0.05 = 20,108$	$430,306 \times 0.05 = 21,515$	$460,428 \times 0.05 = 23,021$	
D. Total Cost (A+B+C)	422,263	451,821	483,449	

## Determining Water Tariff

### A. Uniform Rate Method:

First year number of households= 886  
 Second year number of households= 886 x 1.02 = 904  
 Third year number of household= 904 x 1.02 = 922

$$\text{First year monthly tariff rate} = \frac{422,263}{886 \times 12} = 40$$

$$\text{Second year monthly tariff rate} = \frac{451,821}{904 \times 12} = 42$$

$$\text{Third year monthly tariff rate} = \frac{483,449}{922 \times 12} = 44$$

### B. Consumption Rate Method:

To calculate the Water Tariff rate, from consumption rate method, water demand per person per liter per day is determined. Future population should be calculated by increasing the base year population by the population growth rate and adding it to the base year population.

Base year population = 4833  
 Second year population = 4833 x 1.024 = 4949  
 Third year population = 4949 x 1.024 = 5068

To simplify the calculation, the liter is divided by 1000 to get the result in cubic meter.

$$\text{First year water tariff per cubic meter of water} = \frac{422,263}{\frac{4833 \times 45 \times 365}{1000}} = 5.32$$

$$\text{Second year water tariff per cubic meter of water} = \frac{451,821}{\frac{4949 \times 45 \times 365}{1000}} = 5.56$$

The following years' water tariff rates can be calculated using the same formula.